TASEZ/ELTEK SOLETHU JV: PACKAGE 3: Pack 3 :Excav, Sleeves & Man/h : Internal

The project is the Tshwane Automotive Hub Special Economic Zone, being an industrial park to be developed East of Pretoria. The proposed development is situated adjacent to the Denneboom intermodal public transport facility, which is expected to be the main centre of transport for the employees of the proposed project. The Tshwane Automotive Hub Special Zone development is located on portion RE/89 of the farm, The Willows 340-JR and ERF 10878 of Nellmapius X27, and also on SAMCOR Park X9. These projects are aimed at creating jobs, developing and transferring skills and reducing poverty.

1. INVITATION AND SCOPE OF WORK

ELTEK-SOLETHU JV together with **TASEZ** is inviting SMMEs to submit bids for the **Package 3 :Excavation, Sleeves & Manhole : Internal 4CE only** for Domestic SC that will be participating in the TASEZ SMME Development Programme at Mamelodi District, Pretoria.

CONTRACT / PACKAGE DESCRIPTION	CIDB GRADE AND TRADE
Package 3 :Excavation, Sleeves & Manhole : Internal 4CE only **NB:BIDDERS MUST PROVIDE 1 REFERENCE LETTERS FOR SIMILAR WORKS**	**4CE Only**

The scope of work will entail the following but not limited:

- Excavation and Backfilling
- Cross Cuts
- Cable Marking Tape
- Sleeves and Manholes

2. CONDITIONS

2.1. a) Bidders shall be registered with the Construction Industry Development Board (CIDB) and should have an active CIDB Contractor grading of **4CE only**.

(b) **4CE** Bidders must provide **1X**proof of previous experience of SIMILAR WORK in order to qualify.

2.2. SMME's registered in the TASEZ SMME database within the local Target Area 1 as detailed below are invited:

Target Area 1:

2.2.1. Ward 06: Mamelodi West areas C2, D1, D4 and D5

2.2.2. Ward 15: Nellmapius ext. 6, ext. 7, and ext. 8, Ikageng and Buffer Zone

2.2.3. Ward 18: Mamelodi East, Khutsong extensions, Mamelodi Gardens, sections 14, 15, 16, 17 and 1)

2.2.4. Ward 28: Mamelodi West areas, D2, D3, Moretele View and Buffer Zone

2.2.5. Ward 38: Mamelodi Sun Valley (X 13 and X14)

2.2.6. Ward 41: Bellievue, Meyerspark, Murrayfield, Salieshoek, Silverton and Val de Grace

2.2.7. Ward 43: Dispatch, Eersterust, Silverton (North of Pretoria Avenue) Silvertonedale & Waltloo

2.2.8. Ward 67: Mamelodi; and

2.2.9. Ward 86: Nellmapius, Samcor Park, Willow Brase and Willow Park and Willow Park Manor.

2.3. Public Finance Management Act (PFMA) shall apply.

2.4. Preferential Procurement Policy Framework Act, 2000: Preferential Procurement Regulations, 2017 (80/20 preference point system) will apply as follows: -

Price	80
BBBEE Score	20

2.5. As per amended construction codes, companies with less than 51% black shareholding (QSEs & Generics) are to submit a valid SANAS Accredited B-BBEE Verification Certificate (with the full applicable B-BBEE elements). QSE with at least 51% or 100% black shareholding and EMEs with an annual turnover of above R3 Million are required to submit a B-BBEE verification certificate from a SANAS accredited verification agency as they have to comply with the 40% sub-minimum requirement on the QSE Skills Scorecard to avoid being discounted a level. EMEs with a turnover of less than R3 Million are exempt from complying with the subminimum requirement and may submit an affidavit or a certificate issued by CIPC, confirming their ownership and annual turnover

2.6. Bidders must submit a proof of registration with National Treasury's Centralized Supplier

2.7. Database (CSD) or provide a National Treasury CSD registration number e.g. MAAA0……..…;

2.8. ELTEK-SOLETHU JV will only award the tender to a bidder who is tax compliant. The tax compliance status of the bidders will be verified through CSD and SARS website

2.9. Non-VAT vendors who submit bids for contracts that would, if successful, take their annual turnover above the threshold of R 1 million are obliged to include VAT in the prices quoted and must therefore immediately upon award of the contract register with the South African Revenue Service (SARS) as VAT vendors. The award of contract would be conditional pending the successful bidder submitting proof of registration as a VAT vendor with SARS

2.10. Bidders must submit proof of good standing with COIDA.

2.11. ELTEK-SOLETHU JV will not award more than one active project to one bidder

2.12. Public servants are prohibited from doing any form of business with organs of state, whether in their own capacity as individuals or through companies in which they are directors. Verification will be done and bidders will be disqualified should they be found to be in contravention with the regulations. If the bidder has been granted permission by Treasury, the letter must be provided with the bid document.

Compulsory Briefing meeting for **Package 3 :Excavation, Sleeves & Manhole : Internal 4CE only – Phase 2** will be conducted on Thursday, **17th April 2025** at **10:00 am** at the Skills Centre, 200 Love Street, Nellmapius, Pretoria.

Bid documents will be emailed to attendees of the compulsory briefing on **Thursday, 17th April 2025 from 15h00**.
Bidders are requested to send electronic mails via smmetenders@tasez.co.za for any enquires related to the bid, between the period of **17th April 2025** and **29th April 2025**. No new queries received after **29th April 2025** will be entertained. **ELTEK-SOLETHU JV** will compile a schedule of questions and answers and send to all invited SMMEs.

One original of the completed document shall be placed in a sealed envelope clearly marked: **"Package 3 :Excavation, Sleeves & Manhole : Internal 4CE only "**The closing date and time for the receipt of completed documents is **Wednesday, 30th April 2025 at 12h00.** Documents are to be placed in the tender box at the **PSDC Centre, 200 Love Street, Nellmapius, Pretoria.**

Failure to provide any **mandatory information** required in this document will result in the submissions being deemed null and void and shall be considered non-responsive.
Telegraphic, telexed, tippexed, facsimiled or e-mail submissions will not be accepted.

The completed document will entail:

1.Active 4CE CIDB certificate

2.BBBEE certificate

3.Priced BOQ completed by black pen

4.Proof of address from ward councillor (less than 6 months)

5.1x Reference letters of similar works

6.Organogram

7.Signed and completed Schedule of rreturnable

8. Signed and completed Form of offer

Failure to provide any **mandatory information** required in this document will result in the submissions being deemed null and void and shall be considered non-responsive.
Telegraphic, telexed, tippexed, facsimiled or e-mail submissions will not be accepted.

No telephonic or any other form of communication with any other TASEZ/ ELTEK-SOLETHU JV member of staff, other than the named individual below, relating to this request for tender will be permitted.

ELTEK-SOLETHU JV reserves the right not to accept the lowest quotation in part or in whole or any proposal.

Item No		Quantity	Rate	Amount
	BILL NO. 1			
	PRELIMINARIES AND GENERAL			
	Scheduled fixed-charge and value-related items:			
	Fixed preliminary and general charges			
1	Site Establishment	Item		
2	Value-related preliminary and general charges	Item		
	Scheduled time-related items:			
	Time-related preliminary and general charges			
3	Monthly Toilet, Container and Offices hire	Item		
4	Water and Electricity during Construction Period	Item		
5	Management Of Construction Work	Item		
	Compliance with OHS Act and Regulations (including the Construction Regulations, 2014)			
6	Allow for the compulsory equipment and clothing, i.e. Hats, safety shoes, safety clothing, safety glasses, safety masks, harness etc.	Item		
7	Allow for the submission of a health and safety file	Item		
8	Allow for provision of Basic Emergency Preparedness and Response equipment & Safety Reps	Item		
9	Covid-19 Healthy And Safe Work Practices	Item		
	Pre-employment and exit medical assessments as per Health and Safety Requirements			
10	Allow for Pre-employment medical examinations	Item		
11	Allow for exit medical examinations	Item		
	Carried Forward		R	

	Brought Forward		R	
	Compliance			
12	Compliance with Socio-economic specifications	Item		
13	Compliance with The Labour Management Regulation	Item		
14	Compliance with the EMP specifications	Item		
	Compulsory Breakdown for the Adjustment of Preliminaries			
15	Value Related	Item		**Rate Only**
16	Fixed Related	Item		**Rate Only**
17	Time Related	Item		**Rate Only**

NOTES

The rates will not be adjusted for escalation, the contract value will be fixed and no claims for adjustment will be entertained for Contract Price Adjustment Provisions.

Contract value is fixed and firm and not subject to fluctuations in the currency rate of exchange.

Subcontractors are to allow opposite each item for all costs in connection therewith. All prices to include, unless otherwise stated, for all materials, fabrication, conveyance and delivery, unloading, storing, unpacking, hoisting, labour, setting, fitting and fixing in position, cutting and waste (except where to be measured in accordance with the Standard System of Measurement) patterns, models and templates, plant, temporary works, returning of packings, duties, taxes, establishment charges, overheads, profit and all other obligations arising out of the agreement.

Items left unpriced will be deemed to be covered in prices against other items throughout these bills of quantities and no claim for any extras arising out of the Subcontractor's omission to price any item will be entertained.

Prices for all plant, temporary works, services and other items provided will include for the supply, maintenance, operating cost and subsequent removal and making

	Carried Forward	R	

Bill No. 1
Preliminaries and General

Brought Forward		R	
good as necessary. The Subcontractor will execute work during "overtime" hours as necessary in order to complete the project within the agreed construction period and will provide such resources and work such overtime hours as necessary. Costs for the execution of this work under these conditions will be included within the contract sum. The Tender Sum to be submitted is to be priced as per the specifications in the Provisional Bills of Quantities of the tender documents. The rate inserted by the Subcontractor opposite each Item will be deemed to be applicable to the item as originally specified. Should the Subcontractor wish to offer an alternative specification to any particular item, the Subcontractor is to provide this as an alternative to their Tender Sum for consideration by the Engineer. Under no circumstances are the descriptions and quantities in the Provisional Bills of Quantities to be altered by the Subcontractor. New rates filed in terms of the Contract shall be based upon labour, plant, material and profit costs in use at the time of tendering The priced Bills of Quantities of the successful Subcontractor will be checked and the Engineer reserves the right to call for reasonable adjustments to any individual price and to rectify and discrepancy whilst the total price, as submitted, remains unchanged. All prices/rates to be net, excluding Value Added Tax			
Carried to Summary		R	
Bill No. 1 Preliminaries and General			

Item No			Quantity	Rate	Amount
	BILL NO. 2				
	SLEEVES AND MANHOLES				
	Excavate and Backfill per Linear Meter				
	Excavate and Backfill (600mm wide x 1000mm deep)				
1	Soft Soil Bedding	m3	300		
2	Pickable soil	m	6,000		
3	Extra over for Soft rock	m	500		
4	Extra over for Hard rock	m	100		
5	Extra over for Chemical blasting	m	50		
6	Import material for bedding	m3	300		
7	Backfill and compact to min 91% MOD AASHTO	m	6,000		
	Cross Cuts - 3m x 1.6m x 1.1m				
8	Crosscut, Backfill, Compact to min 91% MOD AASHTO	No	6		
	Cable Marking Tape				
9	Supply	m	6,000		
10	Install	m	6,000		
	Sleeves and Manholes				
11	Supply and install 110mm diameter PVC sleeves	m	12,000		
12	Supply and install RHI-NODE-DUDC 1000 IP 68 manhole fully populated with splice trays	No	2		
13	Supply and install RHI-NODE 1000 IP 65 manhole	No	64		
14	Supply and install RHI-NODE 600 IP 65 manhole	No	20		
15	Supply and install RHI-NODE 400 IP 65 manhole	No	30		
	Carried Forward			R	

				R
	Brought Forward			
16	Manhole casting including 900 x 900mm concrete plinth	No	144	
	Fibre Optic Cabling			
17	Fibre optic cabling for SCADA system	m	12,000	
	Carried to Summary			R

Bill No. 2
Sleeves and Manholes

FINAL SUMMARY

Bill No		Page No		Amount
1	Preliminaries and General	3		
2	Sleeves and Manholes	5		
	Sub Total (Excluding Vat)		R	
	Add Vat @ 15%		R	
	GRAND TOTAL (Including Vat)		R	
	Carried to Form of Tender		R	

TASEZ PHASE 2: ELECTRICAL BULK SERVICES INFRASTRUCTURE PROJECT

BULK INFRASTRUCTURE SERVICES TECHNICAL SPECIFICATIONS

INTERNAL INFRASTRUCTURE SERVICES

SECTION A

APPLICABLE SANS 1200 STANDARDIZED SPECIFICATIONS

The following SANS 1200 Standardized Specifications for electrical engineering construction are applicable:

- SANS 10142-1 and 2 – National Standard for the wiring of premises
- SANS 10400 – National Building Regulations
- SANS 10114 – National Lighting Standards
- SANS 62305 – Protection Against Lightning
- SANS 780 – Distribution Transformers
- SANS 97 – PILC Cables not exceeding 33kV.
- SANS 6281 and 2 – Testing Methods Cables
- SANS 10198 – Installation of Electric Power Cables not exceeding 33kV
- Latest Typical Standard Details

A1 SCOPE OF WORK

Electrical Infrastructure Scope of Works

The electrical bulk services infrastructure scope of works will include the following:

Waltloo 3 Infrastructure Network

- The supply, delivery to site, offloading, placing into final position, installation and guarantee of all the electrical and communications bulk services and associated loose equipment, MV cables, fibre optic communications cables, as specified in this document and accompanying drawings.
- Build a brick build 20MVA TASEZ Phase 2 Distribution Substation on Erf 2 complete with 11kV switchgear as per schematic diagram
- Build a brick build S1 substation complete with 11kV switchgear on Erf 1 as indicated on the schematic diagram
- Supply & install a 4 MVA metering type RMU on Erf 2 as indicated on the schematic diagram & layout plan
- Supply & install a 4 MVA metering type RMU on Erf 3 as indicated on the schematic diagram & layout plan
- Supply & install a 500 kVA 11kV/400/231V minisub for Streetlights as per schematic diagram & layout drawings
- Supply & install a 25mm² x 4 core PVC insulated copper cable & 16mm² BCEW from minisub to streetlights as per layout drawings & schematic diagram
- Earthing system to substations and MV reticulation.
- Trenching, backfilling and compacting of cable routes for MV cabling.
- The reinstatement of roadways, driveways, paving and gardens required once the MV reticulation has been installed.
- Sleeves, horizontal drilling and road crossings.

- Supply and installation of a SCADA communications and control system to new MV infrastructure including fibre optic cable.
- Streetlighting installation to TASEZ Phase 2 development (including existing Vonkprop Road)
- Testing, commissioning and handover of the bulk supply infrastructure to CoT on completion of the project.
- Testing, commissioning and handover of the bulk supply infrastructure to CoT on completion of the project.

ICT and Communications Infrastructure Scope of Works

The ICT and Communications bulk services infrastructure scope of works will include the following:

- Trenching, backfilling and compacting of cable routes for fibre optic cabling.
- Supply and installation of sleeves, manholes and road crossings for fibre optic cabling.
- Supply and installation of fibre optic communication cabling.

From the above, the Electronic Services Engineer will prepare an ICT and fibre network infrastructure network for the TASEZ Phase 2 development and include the providing of services to all erven with the Phase 2 of the development.

A2 NATURE AND SCOPE OF WORKS

1. General

This Technical Specification details the ***Internal Infrastructure Services*** for the TASEZ Phase 2 Development.

2. MV Reticulation Infrastructure

MV cabling from the TASEZ Phase 2 Development 11 kV bulk distribution substation will consist of 300 mm^2 3-core Al 11 kV XLPE cables supplied and installed in ring formation to CoT specifications and standards. The MV cable route for the installation of these cables is depicted on the Stage 3 Detailed Design Drawings.

All cables will be tested in accordance with SANS and CoT requirements prior to energization and commissioning.

MV Cable Trenching and Installation

All trenches for MV cabling shall be a minimum of 600 mm wide and 1 000 mm deep. MV cables will be laid in accordance with the detailed trenching detail indicated on the technical drawings included in this RFQ.

All trenches are to be backfilled and compacted in 150mm layers to 91% MOD ASHTO with compaction test results being forwarded to the Electrical Engineer for approval.

Provision has been made for horizontal drilling and the installation of 160 mm diameter sleeves to an anticipated road crossings identified on the cable route. Provision has been made for the re-instatement of gardens and walkways together with driveway crossings identified on the cable route.

MV cable route markers shall be provided every 100 m and when the route changes direction. The cable markers shall be encased in concrete and shall be buried at least 250 mm below final ground level and shall protrude by at least 150 mm.

3. ICT Fibre Optic Communications Infrastructure

The Tshwane Automotive Special Economic Zone (TASEZ) Fibre Expansion project is focused on developing the concept design for the expansion of the existing fibre optic infrastructure within Phase1 to the Phase 2 precinct. It will also expand the infrastructure to cater for a residential component via a PON (Passive Optical Network) which will be fed from the expanded fibre network from phase 1. The additional fibre infrastructure will also provide capacity for Security (street surveillance).

With the expansion of the Fibre network, the project will also be responsible for the relocation of the temporary distribution cabinet located outside the new Data Centre. The new location for the distribution cabinet will be inside the new Data Centre. In addition to this, all-existing concrete manholes will be upgraded to a more secure and IP rated chamber to protect against vandalism and water ingress.

4. Building Works

An 11 kV TASEZ bulk distribution substation will be required to be constructed for the TASEZ Phase 2 Development. This substation will house the City of Tshwane incomer feeder switchgear and feeder switchgear providing the MV supply to the individual TASEZ Phase 2 Development erven.

Erven 1 to 4 will be provided with a metered MV supply connection from the TASEZ Phase 2 MV Bulk Distribution Substation by means of either a metering RMU or substation, based on the demand allocation for the erf.

The TASEZ Phase 2 20 MVA Bulk Distribution Substation will be located on erf 2, as indicated on the MV reticulation drawings included as part of the Stage 3 Detailed Design. Construction of this substation will be in accordance with CoT standards and specifications and will require a servitude registered in favour of the CoT over the substation building.

Erven 1 and 4 in the TASEZ Phase 2 Development will be provided with S1 Type Consumer MV substations as detailed in the technical drawings included in this RFQ.

Erven 2, 3, 5, 6, 7 and 9 will be provided with metering type RMU's and Miniature Substations which will require concrete plinths as detailed in the technical drawings and specifications.

5. LV Reticulation Infrastructure

All cabling will be installed in cable trenches and through PVC sleeves at road crossings. Main LV cabling to will be provided in accordance with CoT standards and SANS. All LV cable terminations shall be the heat shrinkable type. All cabling will be installed in cable trenches and through PVC sleeves at road crossings.

LV cable will be laid on 100mm sifted sand and covered with 100mm sifted sand topping. LV cables to be installed a minimum of 600mm below finished level. All trenches are to be backfilled and compacted in 150mm layers to 91% MOD ASHTO with compaction test results being forwarded to the Electrical Engineer for approval.

LV cable route markers shall be provided every 500m and when the route changes direction. The cable markers shall be encased in concrete and shall be buried at least 300mm below the finished surface and shall protrude by at least 250mm.

6. Reinstatement of Existing Infrastructure

Provision has been made in the provisional Bills of Quantities for the reinstatement of existing driveways, paving, landscaping and infrastructure on completion of the trenching and cable installation.

7. Streetlighting Infrastructure

Street lighting will be installed to all streets within the proposed development in accordance with SANS 10098. Public area lighting will consist of concrete poles of 9m mounting height fitted with LED floodlight fittings fed from a 500 kVA miniature substation on Erf 2 via underground cables.

A detailed street lighting layout is included in the will consist of concrete poles of 9m mounting height fitted with LED streetlight fittings fed from the distribution kiosks with underground cables.

The streetlighting system provides for a 9m steel pole & 3m double outreach with luminaires as per the bills of quantities. The average spacing between poles approximates to 35m.

A3 COMMENCEMENT OF INSTALLATION

Construction work will commence on site as soon as all tender procedures are complete, and the successful tenderer will be required on site shortly after the Sub-Contract is awarded.

A4 SCHEDULE OF DRAWINGS

Tender drawings are indicated on the drawing register and are issued as part of this RFQ.

A5 HANDOVER OF PROJECT

Upon final handover of the project the electrical contractor shall provide 3 x sets of comprehensive as-built drawings, maintenance manuals together with a full set of infra-red scans of all distribution boards as well as the MV equipment and installation.

All documentation is to be prepared in both hard and soft copies. Kindly note that the contract will not be considered complete until such documentation is accepted by the Electrical Engineer and Client.

A6 COMMISSIONING

The Contractor shall allow to commission the entire MV installation in terms of SANS 0142 specifications together with the Engineers and City of Tshwane.

SECTION B

Mv Reticulation Infrastructure – Detailed Specification

B1 DETAILED SCOPE OF WORK

This contract is for the supply, delivery to site, offloading, placing into final position, installation and guarantee of all the streetlights and associated loose equipment, LV cables, pilot cables, as specified in this document and accompanying drawings.

- Build a brick build 20MVA distribution substation on Erf 2 complete with 11kV switchgear as per schematic diagram
- Build a brick build S1 substation complete with 11kV switchgear on Erf 1 as indicated on the schematic diagram
- Build a brick build S1 substation complete with 11kV switchgear on Erf 4 as indicated on the schematic diagram & layout plan
- Supply & install a 4 MVA metering type RMU on Erf 2 as indicated on the schematic diagram & layout plan
- Supply & install a 4 MVA metering type RMU on Erf 3 as indicated on the schematic diagram & layout plan
- Supply & install a 500 kVA 11kV/400/231V minisub for Streetlights as per schematic diagram & layout drawings
- Supply & install a 25mm² x 4 core PVC insulated copper cable & 16mm² BCEW from minisub to streetlights as per layout drawings & schematic diagram

Eerste Fabriek Network

- Supply & install a 4MVA metering type RMU for Erf 6 as per layout plan & schematic diagrams
- Supply & install a 4 MVA metering type RMU for Erf 7 as per layout plan & schematic diagrams
- Supply & install a 500 kVA 11kV Mini Substation for Erf 9 as per layout plan & schematic diagrams

B2 LOCATION OF SITE

The site is situated in Waltloo, bordering Propshaft Road & existing Bronkhorstspruit Road. Tenderers are advised to visit the site to acquaint themselves with the local conditions access to site etc.

B3 ACCEPTANCE AND ADJUDICATION OF TENDERS

Tender bids shall be submitted on the Form of Tender provided, and the total amount shall correspond with the total amount entered in the Schedule of prices. The latter shall be completed in full, the Tenderer clearly stating "no quote" against any item for which a bid is declined.

The Employer reserves the right to accept offers from different suppliers, and the prices offered against each item shall not be affected by the acceptance or not of the other items.

The Tenderer shall submit samples of equipment offered, if requested to do so, for inspection and approval by the Engineer.

B4 GUARANTEE

The Supplier shall include in his tender bid any and all costs involved to ensure that all equipment and materials are unconditionally guaranteed for a period of 12 months from the date of practical completion of the Contract

Such guarantee shall cover all labour and materials to repair equipment in situ within one day of notification of failure. Any defects not remedied within a reasonable time will be effected at the Suppliers risk and expense on the instruction of the Engineer, but without prejudice to any other rights against the Supplier.

The Engineer reserves the right to demand the replacement or making good by the Supplier of any part of the Equipment which is shown to have any latent defect, or not to have complied with the Specification, notwithstanding the fact that such equipment has been taken over or the guarantee period having expired.

B5 WAYEAVES

The tenderer shall be responsible to obtain all necessary wayleaves based on the cable route indicated on the drawings.

The tenderer shall ensure that the wayleaves are approved by all Departments prior to commencing installation of the streetlight cables.

B6 AS-BUILT DRAWINGS

The electrical contractor shall carry out a final as-built survey of the cable and all other installations, including conduit and draw boxes, outlets etc. and submit to the engineer as-built route plans of the complete installation. The following information shall be reflected on the plans or be submitted as separate schedules along with the plans:

- Overall length of each cable
- Locations of all joints in relation to permanent reference points
- Locations of all cable markers in relation to permanent reference points
- The work will be deemed incomplete until all as-built drawings and information have been submitted to the Engineer
-

B7 VOLTAGE CHECK

Upon switch-on by Ekurhuleni the Electrical Contractor shall establish the voltage and ensure that transformer tap settings are correct before energising the LV systems.

B8 BALANCING OF SUPPLY

The Electrical contractor shall ensure that the entire installation is balanced as closely as possible and report the readings to the Engineer in writing.

B9 MAINTENANCE AND INSTRUCTION MANUALS

The Electrical contractor shall prepare and hand hand-over to the Engineer on practical completion 3 x sets of operating and maintenance instruction manuals.

B10 INSTALLATION

The entire installation shall comply with the requirements of SANS 10142 Code of Practice (as amended), as well as those of the local authority.

B11 CABLES

Positioned on northern and western side of the roads at a distance of 2m from the erf (road reserve) boundary. Depth for LT cables is 600mm.

All cables shall be labelled at both ends. (Refer to Ekurhuleni specification).

B12 SLEEVES FOR CABLES

All township roads and new driveways (where positions are known) shall be crossed with 160mm diameter uPVC sleeves where cables are larger than 95mm² x 4 core. Cables being 95mm² x 4 core and smaller may be installed in 110mm diameter uPVC sleeves.

All sleeves shall be equipped with 2mm diameter galvanised steel draw wires.

All sleeves shall be sealed with Styro-foam to avoid ingress of ground and dirt.

Road crossing shall be strictly in accordance with Ekurhuleni specification.

Service cables for one domestic unit where the distance is less than 5m from the CMK to the erf boundary shall not be installed. A 50mm diameter sleeve with a slow bend into the CMK must be provided from the CMK which extends 500mm into the erf at a depth of 600mm.

Only one distribution cable and a maximum of three (3) domestic service cables are allowed per sleeve.

B13 SITE FACILITIES AVAILABLE

Potable water, stormwater, sewer, communication and electrical services are available near the site. The Contractor shall make the necessary arrangements and pay for the required services and for any reticulation and connections and metering and maintenance which may be needed in order to utilise these services.

No illegal water or electricity connections are permitted and all connections shall be in terms of the current Municipal By-laws and regulations. The Employer accepts no responsibility for shortages of any of these axillary services and/or facilities due to any cause whatsoever and the cost of arranging auxiliary power or water supply shall be solely borne by the Contractor and it shall be deemed that the costs of providing such services and/or facilities are covered in the rates tendered.

The Contractor shall be responsible for supplying his own sanitary facilities at his own cost for the remainder of the Contract and such cost will be deemed to be covered in the rates tendered in the Schedule of Quantities. The Contractor shall ensure that the facilities are kept in a clean and sanitary condition at all times.

Under no circumstances may the Contractor's staff make use of the surrounding buildings, structures, grounds or vegetation as a sanitary facility or litter/wastage disposal area.

B14 SITE FACILITIES REQUIRED

One SAICE type notice board be supplied and erected on site, maintained and removed after completion of the works. A venue for the purpose of holding site meetings must be provided.

This venue can be an office with a desk, six chairs and ventilation where the resident engineer can meet with the contractor and hold site meetings.

B15 FEATURES REQUIRING SPECIAL ATTENTION

Dealing with Traffic

The contractor has to maintain the flow of traffic while ensuring the safety of the road users at all times during the construction period. The Contractor shall furthermore ensure that the accommodation of traffic and other ancillary works comply with the requirements of City of Tshwane Metropolitan Council Roads Department, SANS 1200 and the South African Road Traffic Signs manual Volume 2 chapter 13.

Existing Services

The Contractor must expose all existing services that lie within the area of the works and protect these services throughout the construction period. Exploratory trenches must be hand excavated in the road reserve at regular intervals in such a way that the position and depth of the existing services can be established where excavations will take place.

Although every effort has been given to mark the existing services on the drawings, the contractor must be aware that the possibility exist that unmarked services can be encountered.

Existing services are to be protected and relocated if necessary. The contractor is responsible for contacting the service providers before construction commences and to locate the existing services in liaison with the service providers.

B16 HEALTH & SAFETY

This Contract requires strict compliance with the Occupational Health and Safety Act, 1993 and the Construction Regulations 2014, related thereto.

During preparations of his tender, special attention must be given by the Tenderer to Special Conditions of Contract 1.2, and to the Health and Safety Specification bound into this document. The rates entered in the various items making up the Works and particular items in the Preliminary and General Section in the Schedule of Quantities will be assumed to make due allowance for such compliance and no further monies will be paid to the Contractor for such compliance.

The Contractor shall ensure at all times that his operations do not endanger any property or any member of the public, Employer's staff or staff of adjacent businesses, residences, road users and pedestrians.

The Contractor shall liaise with the Employer to determine the particular Health and Safety rules and regulations pertaining to Main Road site and acquaint himself and his staff therewith and comply with these at all times.

The Contractor shall ensure that all personnel and equipment are fitted with the correct safety equipment and fittings as described in the Health and Safety Act and Construction Regulations and identified in terms of the Health and Safety Specification and the Contractor's own risk assessments.

The Contractor shall appoint the required safety officers to ensure Health and Safety Act compliance at all working areas within the site for the entire contract.

The Contractor is to ensure that all safety clothing, i.e. hardhats, safety boots, day-glow vest, gloves, eye protection etc. as required are used by all his staff, Sub-contractors' staff and other visitors to the areas of work

within the site at all times and shall ensure that sufficient additional personal protective clothing is available within the site offices for use by all parties present at the site meetings and site visits.

Access to the site shall be restricted to the Contractor's and his Sub-contractors personnel and to the authorized agents and authorized staff of the Employer.

The Contractor shall supply the Engineer with a fortnightly schedule of personnel, plant and equipment to be employed on the Contract. The Contractor shall ensure that the personnel remain within the confines of the site and the costs related thereto shall be covered by the rates tendered in the Schedule of Quantities.

Should the Contractor not comply with the Occupational Health and Safety Regulations, the Engineer or his representative may instruct the Contractor to suspend all work to the site until the regulations are complied with, the cost of such standing time being for the account of the Contractor.

B17 MATERIALS ON SITE

No materials on site will be paid for.

B18 INVOICES

Invoicing is to be provided as per the conditions of contract and notes to tenderers.

B19 VARIATION ORDERS

Any variation to the contract is to be approved by the project manager before the additional work is to commence. This is to be through a formal request from the contractor accompanied by a letter from the engineer with a cost breakdown of the value of the variation order.

B20 APPLICABLE STANDARD SPECIFICATIONS

- The South African Bureau of Standards Code of Practice for the Wiring of Premises, SABS 0142-1987, referred to herein as the `Wiring Code'.
- The Machinery and Occupational Safety Act of 1983 as amended.
- The Municipal By-laws and Regulations and any regulations of the Supplier of Electricity.
- The Local Fire Office Regulations.
- Regulations of the Department of Posts & Telecommunications.
- The applicable SABS Specifications and Codes of Practice or the BSI or IEC Specifications and Codes of Practice where no SABS Specifications or Codes of Practice exist.
- The regulations of the local gas supplier where applicable.

- The National Building Regulations SABS 0400 effective October 1988 as amended.

B21 ALLOWANCE FOR SECURITY GUARDS ON SITE DURING CONSTRUCTION

A sum has been allowed for the appointment of security guards by the Contractor to monitor the area of the construction works. Details of the company providing the security services must be submitted to the Engineer for approval. The rate will include for sufficient security guards for the duration of the contract, but at least two at any particular point in time.

The Contractor's attention is drawn to the fact that work will occur simultaneously in areas remote from each other and the security arrangements shall sufficiently accommodate this. This sum will be only paid if security personnel are actually on site.

B22 RELOCATION OF EXISTING SERVICES

The provisional sum allowed for under PSA 3, includes for the cost of all authorised relocation carried out by the owner and/or entity responsible for the service on the instructions of the Engineer.

The Contractor will be required to pay for all relocations instructed by the Engineer and the Contractor will be reimbursed for the invoiced costs plus a mark-up as specified in the SOQ through the payment certificates. Measurement and payment will be based on invoices submitted to the Engineer.

B23 RELOCATION OF EXISTING TRAFFIC SIGNALS

A provisional sum has been allowed for the cost of the relocation of traffic signal poles and heads as well the provision for cabling and sleeves. The provisional sum shall also cover the cost of re-erection as directed by the Engineer.

B24 FOR COMPLIANCE WITH HEALTH & SAFETY ACT 2003

The sum tendered shall include for full compliance with provisions, conditions and requirements as described in Clause 1.2 of the Special Conditions of Contract, Clause PS11 of the Project Specifications and the Health and Safety Specification included as Section 11 of this document.

Payment will be made as a single instalment for fixed charge items and in monthly instalments for "time related items."

B25 REMOVE, STORE & RE-ERECT EXISTING STREETLIGHTS

Street Lights identified to be removed will be removed, stored and re-erected in liaison with Ekurhuleni.

The rate shall cover the cost of careful removal of Street Lights to secure storage until reinstatement as well as the cost of reinstatement.

The Contractor shall keep an record of the exact positions where Street Lights were positioned and ensure that these are repositioned in these exact locations, the cost of which will be deemed covered by the rates tendered for this item.

SECTION C

TECHNICAL SPECIFICATION – TYPE S1 CONSUMER SUBSTATIONS

(Single Busbars)

C1 COMPLIANCE WITH REGULATIONS AND STANDARDS

1. The MV Switchgear shall comply with the latest revisions and amendments of the following :
   - The South African Bureau of Standards Code of Practice for the Wiring of Premises, SABS 0142-1987, referred to herein as the `Wiring Code'.
   - The Machinery and Occupational Safety Act of 1983 as amended.
   - The Municipal By-laws and Regulations and any regulations of the Supplier of Electricity.
   - The Local Fire Office Regulations.
   - Regulations of the Department of Posts & Telecommunications.
   - The applicable SABS Specifications and Codes of Practice or the BSI or IEC Specifications and Codes of Practice where no SABS Specifications or Codes of Practice exist.
   - The regulations of the local gas supplier where applicable.
   - The National Building Regulations SABS 0400 effective October 1988 as amended.
2. No claims for extras for failure of the Manufacturer to comply with any of the regulations and standards listed above will be considered.
3. Where conflict appears to exist between any of the regulations and standards listed above and the specification, refer such conflict to the Engineer in writing for his ruling.

C2 MATERIAL AND EQUIPMENT

1. All material and equipment shall conform in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards or where no such standards exist, with the relevant current Specification of the British Standards Institution.

2. All material and equipment shall be of high quality and suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which materials are installed, stored and used.

3. The manufacturer shall, where requested to do so, submit samples of equipment and material to the Engineer for approval before installation.

C3 GENERAL

3.1 General Detail and finishing

1. All indoor MV switchboards shall be of the indoor extensible metal clad type, provided with an integral flush-mounted instrument and relay panel associated with each breaker, switch or isolator panel unless otherwise specified or approved.
2. The Contractor shall also be responsible for the off-loading, erection, levelling and grouting of all switchgear and shall provide all the necessary tools, staging, lifting tackle, etc., for off-loading, handling and installation of the switchgear, and these items shall be removed from site when erection is completed. The switchgear shall be high voltage tested after erection.

3.2 Switchboards - General

1. Switchboards shall be laid out electrically and physically as specified or approved and shall be vermin proof and where possible, dust proof unless otherwise specified or approved. The housing shall be made from sheet metal steel having a minimum thickness of 2mm.
2. Switchboards shall be designed to allow for extensions as indicated on the drawings, and as specified.
3. Switchboard colour shall be as specified to SABS 1091 or as approved. All interior parts of switchboards shall be finished in white. All visible control switches, etc. shall be either black or chromium plated.
4. The layout of the panels shall be such that when facing the front of the board, the sequence of panels is as stated in the schedules and / or as indicated on the diagrams.
5. Cable boxes complete with all accessories and compound must be provided to suit cable sizes as specified. All cable boxes shall be arranged for bottom entry, unless otherwise specified or approved.
6. Available space for MV switchboards is indicated on the drawings. The Contractor must ensure that switchgear can fit into the available space, with proper allowance for working space behind and alongside boards and sufficient room in front of the boards to allow breakers to be racked out.
7. Each circuit shall be provided with individual cubicles so arranged that accidental contact with live metal in adjacent circuits is impossible.
8. It shall be possible to make off all cables of any circuit without exposure to any live conductors on the same circuit with the busbars energised.
9. On withdrawal of circuit breakers, all live parts must automatically be covered by shutters of robust mechanical design. Provision shall be made for padlocking these shutters in the closed position. Busbar shutters shall be clearly marked "busbars" in white lettering on red.
10. All panels shall be fitted with anti-condensation heaters each provided with an isolator suitable for 240V AC operation. Easily accessible terminals shall be provided on the boards where the 240 volt AC supply can be connected. The same supply shall be used for the DC tripping unit.
11. The Contractor shall be responsible for all the wiring and terminations.
12. Suitable cable boxes for MV cables and gland trays for LV cables shall be provided on all panels. Cable boxes shall be individually earthed to the earth bar.

13. All metal parts other than those forming part of electrical circuits shall be connected to an earth bar of 40mm x 4mm section run along the bottom rear of the switchboard. The earth bar shall be earthed at both ends of the switchboard to the substation earth bar. The earthing bar shall be in an accessible position to allow for earthing of the cables. The Electrical Contractor shall ensure that the non current- carrying parts, are connected to the earth bar either by means of their mounting arrangements on the panel or by means of a special earthing conductor fitted with lugs for attaching to the earth bar.
14. To minimise the effect of electrolysis, coils shall be so placed in the circuit that they are not connected to the positive pole of a battery except through normally open contacts.
15. Where a switchboard is made up of a number of units, some with relays or instruments and others without, all units without relays or instruments shall be fitted with blank panels to present a uniform appearance.
16. Where switchgear is provided with doors, they shall be provided with non-ferrous fasteners designed to draw the panel closed. The doors shall have at least three points of latching and shall be suitably reinforced to prevent distortion when open. Doors shall be lockable by means of a padlock.
17. Doors shall have stops to prevent overswing of the door when opening and to prevent interference with adjacent panels.

3.3 Type of Switchgear

1. The Contractor shall offer vacuum or SF6 insulated switchgear, unless otherwise specified.
2. Full details of equipment offered shall be submitted at tender stage.

3.4 Characteristics of Switchgear

1	Number of poles	3
2	Type	As specified.
3	Rated Voltage	The switchgear shall be suitable for an earthed system for the rated voltages as set out in the project specification.
4	Rated impulse withstand voltage (peak):	75kV unless otherwise specified.
5	Fault rating	250MVA
6	Rated frequency :	50Hz unless otherwise noted.
7	Duration of short circuit:	3 seconds
8	Phase rotation :	Clockwise, Red-White-Blue, unless otherwise specified.

3.5 Busbars

1. Switchgear shall be single busbar type.
2. Switchgear shall be single busbar type.

3. All busbars and droppers shall be of suitable cross-section to comply with BS 159 with regard to temperature rise at the specified altitude and of sufficient mechanical strength for normal and fault conditions.
4. All busbars and connections shall be air insulated and shall be taped and / or shrouded on all straight sections and joints where possible and shall withstand the full power frequency test voltage.
5. All joints and tees in busbar connections shall preferably be made with shererised bolts, nuts and washers of not less than 12mm diameter. l0mm Diameter high tensile (black) bolts having a reference symbol "R" for the tensile range in accordance with BS970 will be accepted as an alternative. In this case proof of the tensile range shall be provided during the manufacture stage.
6. The design of busbars and the overlaps and joints in busbars shall conform to the applicable SABS specification and all joints shall be made with at least two bolts.
7. Busbars and connections shall be clearly colour-marked with the respective phase colours : Red, White, Blue.
8. The busbar chamber shall be completely vermin proof.
9. Busbars extending through fire walls shall be fitted with fire barriers and shall have a fire rating of at least 2 hours.

3.6 Impulse Withstand and Corona Levels

1. The complete switchboard assemblies shall withstand one-fifth microsecond volt wave with a peak value of 75kV successively at sea level conditions. Certified copies of test certificates issued by a recognised testing authority in this respect shall be submitted with the tenders.
2. The ends of the busbar chamber shall be blanked off with easily removable steel covers to allow for expansion of the switchboards.

3.7 Auxiliary Switches

1. Equipment shall be suitable for remote indication, auxiliary switches shall be provided to give the status of the switchgear.
2. 2.Over and above the number of auxiliary switches specified above, two normally open and two normally closed spare auxiliary switches shall be provided.
3. All the auxiliary switches on each panel shall be wired to an easily accessible terminal block at the back of each panel.

3.8 Instrumentation and Lamp Indication

1. Metering instruments shall conform to the requirements specified herein. Metering instruments and lamp indication shall be provided as specified.
2. Where indicating lamps are supplied by the batteries, it shall be separately wired from the mechanism and tripping circuits to an easily accessible terminal block at the back of a panel.

3.9 Cable end boxes, clamps and terminations

1. Suitable cable end boxes and / or clamps shall be provided for the type(s) and sizes of cables as specified.
2. The Contractor shall ascertain from the Engineer before the manufacture of the panels the type and size of cable box to be used, depending of the choice of PILC cable or cross-linked polyethylene cable and copper or aluminium core cable.
3. The switchgear riser terminals shall be properly tinned.
4. Where cross-linked polyethylene cables are used, the switchgear manufacturer shall provide suitable tinned lugs, bolts, nuts and washers for the sizes of cables to be used.
5. Where paper insulated cables are used, the switchgear manufacturer shall provide suitable cast iron or sheet steel fabricated compound filling cable end boxes suitable for the sizes of cables to be used. The switchgear manufacturer shall also provide the necessary flexible or copper bar connections between the riser terminals and the cable end box terminals.
6. Cable end boxes with sealed stem bushings shall be provided. Cable boxes shall be large enough for phasing out cables. Special manufacture cable end boxes shall be used for cables larger than 120mm2

3.10 Earthing Arrangement

1. All switchgear shall be so constructed that it is possible to earth the cables. It must not be possible to earth the busbars under any circumstances.

3.11 Labelling

1. All switchgear shall also be provided with a similar label at the back of the panel. Where possible labels shall not be fixed to removable panels or doors.
2. All switchgear shall be provided with a manufacturer's label fixed in an easily accessible position inside the instrument panel showing the following data:
   - Fault capacity
   - Line Voltage
   - Maximum current carrying capacity of busbars
   - Maximum current carrying capacity of circuit breaker or isolator
   - Voltage transformer ratio (where applicable)
   - Current transformer ratio and Class (where applicable)
   - Manufacturer
   - Type and serial number

3.12 Anti-condensation heaters

1. Anti-condensation heaters shall be installed in the busbar and current transformer chambers.
2. The heaters shall be supplied from the voltage transformer or an external supply where this is available.

3.13 Panel Wiring

1. All panel wiring shall be PVC insulated and no insulated wire shall have less than three strands. The cross-sectional area of wires shall not be less than 2,5mm.
2. Each end of each wire or control cable connection shall be provided with a ferrule and a number corresponding to that on the diagram of connections.
3. Additional red ferrules marked "T" in white, must also be fitted on all wires associated with trip circuits.
4. All terminal blocks for current transformers, relay and instrument connections shall be neatly finished and readily accessible. Terminal strips which do not rely on pinch screws rotating on the wire strands shall be provided and full details and samples of the terminal strips proposed, shall be submitted to the Engineer for prior approval.
5. The design of the wiring cleats where used, shall be such that only limited pressure can be transmitted to the wires.

3.14 Cable Trench checker plate supports

1. Suitable adjustable treated angle irons shall be fitted to the bottom frame of switchgear to support the checker plates of indoor substation cable trenches.

3.15 Tools

1. If the design of switchgear is such that integral earthing of cables is not possible, then suitable earthing equipment shall be provided for each type of circuit breaker and isolator for each substation or switch room.
2. Suitable testing equipment and jumpers shall be provided for the switchgear for each substation where the design of switchgear requires such equipment.
3. At least two spring charging handles, operating handles and door keys shall be provided for each substation or switch room.
4. Wall mounted brackets shall be provided for carrying the manual, operating handles and test jumpers.
5. If special tools are required, a complete set of chrome finished case-hardened spanners and special wrenches to fit every nut and bolt on the equipment supplied, shall be provided under this contract. Any special tools or keys that may be required for effecting adjustments of parts as well as all standard earthing and test equipment, shall also be provided.
6. These tools shall be accommodated in suitable, neat, properly designed, wall constructed steel equipment board with the tool positions marked. The board shall be capable of being locked by means of a padlock.
7. A fully detailed list of tools shall be supplied before delivery.
8. The tools shall not be used for the erection of the contract works.

3.16 Spare Fuses and Lamps

1. One spare fuse shall be provided for each LV fuse used on the switchgear. Two spare lamps shall be provided for each lamp type used on the switchgear. The spare lamps and fuses shall not be used by the Contractor.

C4 CIRCUIT BREAKERS

4.1 General

1. All circuit breakers shall be of the triple-pole , vertical or horizontal isolation, draw-out truck type, fitted on separate frame with wheels.

4.2 Ratings

1. The circuit breakers shall be capable of carrying the normal currents as specified at the site altitude.
2. The circuit breakers shall be capable of interrupting the symmetrical and asymmetrical fault currents and also making and latching against the current stated on the schematic drawings at the minimum voltage specified.
3. Each circuit breaker shall be clearly marked to show the current and MVA ratings to which the breaker has been satisfactorily tested.

4.3 Operating Mechanisms

1. Circuit breakers shall be provided with spring operated mechanisms with hand spring charging, or solenoid mechanisms as specified.
2. Spring and solenoid operated switchgear shall be provided with electrical control switches on the instrument panels for local closing and tripping as specified.
3. The total break times measured from the instant of energising the trip coil to final arc extinction shall be less than 100ms.
4. An approved method for locking the control switches in the neutral position shall be provided.
5. The circuit breakers shall be fitted with an electrical tripping push button mounted on the instrument panel.
6. If motor wound spring mechanisms and/or solenoid mechanisms are offered, then the Contractor must ensure that suitable batteries with sufficient capabilities are provided to supply the motors and/or solenoids respectively.

4.4 Anti-pumping

1. All circuit breakers shall be of the trip-free type and means shall be provided to prevent pumping while the closing circuit remains energised and the breaker either fails to latch or trips during closing due to the operation of the protective relays. The arrangement shall be to the approval of the Engineer.

2. Where anti-pumping relays are provided, they shall be continuously rated.

4.5 Closing Devices

1. All electrically operated closing devices shall be at least suitable for operation at any voltage between 100 percent and 80 percent of the nominal control voltage at the device terminals . The maximum and steady state current at nominal voltage required by each closing device shall be stated in the Schedules.
2. All operating coils of closing coil contactors, shall be continuously rated. The contacts, however, may be short-time rated.
3. The closing coil circuit shall be provided with a normally closed auxiliary contact which opens when the circuit breaker is latched closed, so as to prevent repeated closing signals being given to the coil.
4. Circuit breakers and contactors shall be fully interlocked such that it will not be possible to withdraw, lower or plug the units in before it is tripped. It must not be possible to close the unit before it is fully plugged in or fully withdrawn to the “test”, “service” or “earth” positions. It shall also be fully interlocked against any other maloperation that might be possible and peculiar to the type of equipment offered. It shall be sufficiently interlocked to make it completely safe for operation by personnel not familiar with the equipment.

4.6 Tripping Devices

1. All electrical tripping devices shall be of the shunt type suitable for operation at any voltage between 120 percent and 80 percent of the nominal voltage at the device terminals. The maximum and steady state current at nominal voltage required by each tripping device shall be stated in the schedules.
2. The tripping devices of a circuit breaker, when the circuit breaker is not carrying current, shall be capable of operating satisfactory down to 50% of the nominal auxiliary supply voltage measured at the device terminals.
3. A normally-open contact operated by the breaker mechanism shall be placed in series with the trip coil and shall be capable of interrupting the maximum trip coil current.

4.7 Indicating Services

1. A mechanical indicating device to show whether the breaker is open or closed shall be provided. The device shall be labelled ON and OFF and shall be clearly visible from the front of the panel.
2. A mechanical indicator shall also be provided to indicate whether the breaker is racked in or out.
3. All mechanical indications shall be clearly visible from the front of the panel, otherwise additional electrical indication shall be provided.
4. In all cases positive indication must be provided.
5. All circuit breakers shall be clearly marked to indicate the correct panel into which each unit should be plugged.

4.8 Isolating Devices

1. Circuit breaker spouts and sockets shall be such that all circuit breakers of similar type and current rating shall be interchangeable. It shall not be possible to insert a circuit breaker into a higher rated circuit.
2. All fixed portions of isolating devices and connections thereto shall be of the same current rating as the associated circuit breaker.
3. Automatically operated shutters shall be provided so that on withdrawal of the circuit breaker spouts, these shutters cover the sockets automatically to prevent inadvertent contact with live busbars.
4. Facilities shall be provided for padlocking the circuit breakers in the "racked in" and "racked out" position and also the spout shutters.
5. With units withdrawn to the "test" or "service" position , provision shall be made for reconnection of the auxiliary circuits for testing purposes. In cases where this necessitates the use of a separate jumper plug or other arrangement, the contract price shall include for the supply of at least one such jumper plug or other device per separate switchboard.

4.9 Mechanical Interlocks and Safety Shutters

1. The following minimum interlocks are required:
   - It must not be possible to raise, lower or withdraw the circuit breaker unless tripped.
   - It must be impossible to close the circuit breaker unless it is either fully plugged-in, fully withdrawn or earthed.
   - It must be impossible to plug the circuit breaker or to close it unless the truck is properly secured.
   - On withdrawal of circuit breakers, all live parts must automatically be covered by substantial vermin-proof shutters. Shutters shall be provided with means for padlocking in the closed positions.
   - In instances where the control and protection circuits are connected by multicore cable and a plug to the circuit breaker mechanism contacts, additional interlocking is required to prevent the circuit breaker being closed in the operating position without the protection circuits being connected.
2. All safety shutters shall be clearly and indelibly labelled in letters of the largest practical size, indicating the live apparatus screened off by the shutters.

4.10 Relays

1. Each circuit breaker shall be fitted with protection and auxiliary relays as specified on the drawings and schedules.
2. Where the circuit breaker is to be equipped for remote indication and control, all the relay auxiliary switches shall be wired to an easily accessible terminal block on the back of each panel.

3. Solid state relays shall be provided. Allowance shall be made for additional terminal blocks on every panel for testing purposes. Combined solid state overcurrent and earth fault relays must be equipped with indicating flags showing the cause of the tripping either earth fault or overcurrent.

4.11 Auxiliary Switches

1. Circuit breakers shall be provided with sufficient direct auxiliary contacts to suit the circuits served. In addition , at least four spare contacts shall be provided. These spare contacts shall be readily convertible from normally-opened to normally-closed operation and shall be completely wired to an accessible terminal board adjacent to the outgoing control cable termination. Auxiliary contacts shall be coupled in such a manner as to follow positively the operation of the switching device concerned and no slave relays shall be used to provide additional contacts. Means shall be provided for adjusting the auxiliary contacts relative to the operating mechanism.
2. Where insufficient contacts are available a slave relay shall be provided but shall be used for indication only.

4.12 Circuit Breaker Truck Connections

1. Where the auxiliary control connections between the circuit breaker truck and the fixed housing are made by means of flexible connections, these shall be contained in a flexible tube. If metallic flexible tubing is provided this shall be PVC covered to the Engineer's approval.

C5 ISOLATORS AND SWITCHES

5.1 General

1. All isolators and switches shall be of identical construction to the circuit breakers specified above but without protection.

C6 TESTING

6.1 Type testing

1. Type Tests shall be carried out on each switchgear type to be installed. Manufacturer’s type test will be acceptable.

6.2 Routine Testing

1. Routine tests shall be made on all switchgear at the manufacturers works to ensure that the equipment complies in every respect with the operational requirements and the applicable standard specification.

6.3 Site Tests

1. Switchgear shall be impulse and operation tested on site prior to commissioning and as specified.

C7 INSTALLATION AND ERECTION

7.1 Alignment and Fixing of Switchgear

1. All indoor switchgear panels shall be properly aligned, erected, plumbed, bolted together and fixed onto the floor.
2. If the floor is not level, suitable packing shall be used to level the switchboard.
3. The contractor shall ensure that switchgear can be freely operated without any physical obstruction after the switchgear has been placed in position.
4. Each individual panel shall be levelled before the panels are bolted together.
5. The panels shall be assembled and erected strictly in accordance with the manufacturer's instructions.
6. Switchgear trucks shall move freely and shall be properly aligned.

C8 TRIPPING BATTERIES AND TRICKLE CHARGERS

8.1 General

1. The trickle chargers and battery cabinets shall be enclosed in an adequately ventilated steel enclosure.
2. Each set or bank of batteries shall be provided with a separate battery charger.
3. Each set or bank of batteries shall be housed in a separate self-contained floor-standing metal-clad cabinet as one unit.
4. The battery charger shall be connected to a terminal block at the back of the switchgear panel by means of PVC cable and shall be supplied from the voltage transformers.
5. No fuses or circuit breakers shall be installed in the trip circuits from the batteries to the switchgear panels.
6. The sizes of the AC and DC cables between the battery unit and switchgear panels shall be suitable for the loads of the equipment. The cost of the cables shall be included in the price for the supply of the battery unit.
7. Where lights are specified on switchgear and control panels to be supplied from the batteries, the supply to the lights shall be separated from the mechanism and tripped circuits by means of a separate cable to be installed to the switchgear or control panels.

8.2 Batteries

1. Where spring charging motor and solenoid mechanisms are used, 110V battery sets shall be provided for the supply of the mechanisms as well as for tripping and closing coils. 110V or 32V battery sets shall be provided.
2. Where lights are specified on switchgear and control panels to be supplied from the batteries, the supply to the lights shall be separated from the mechanism and tripped circuits by means of a separate cable to be installed to the switchgear or control panels.
3. The battery sets offered shall be fully capable of providing the load requirements of all motors, lamps, relays, coils, etc.

4. The battery sets shall be capable of providing the full standing load of all associated equipment during complete failures of the AC supply, for a minimum period of 6 hours, after which period it shall be possible to open and close all circuit breakers once in rapid succession.
5. The cells shall be so arranged that the electrolyte is clearly visible and the batteries easily maintained.
6. All batteries shall be of sealed type, unless otherwise specified.

8.3 Charging Equipment

Rectifier

1. The unit shall comprise a solid state type rectifier with a double wound transformer.
2. The output voltage shall not vary more than 1% in variations of 10% of the input voltage at ambient temperature ranges at the site.
3. The charger shall be of the constant voltage control type with a higher (booster) and lower (trickle) rate of charge. The higher rate of charge shall be such as to completely charge a fully discharged battery in a period of 15 hours.
4. The capacity of the charger shall be such that it can provide the full standing load plus battery charging current.

Instruments

The following instruments are required:

- DC ammeter for charging current
- DC voltmeter for battery voltage
- Loose voltmeter to measure cell voltage.

Indication Lights

An indication light is required to indicate each of AC supply healthy and common fault.

Switches and Fuses

The following switches and fuses are required:

- A main switch to isolate the AC input
- Fuses on the DC and AC sides except in the trip circuits of the switchgear.

Control of the Charge Rate

The charge rate shall be automatically controlled.

Protection and Alarms

If a standing load is to be supplied to switchgear and control panels then the following protection systems with alarms shall be provided to trip the standing load supplied:

- AC supply fail relay with time delay

- DC under-voltage relay with 90% setting

Tripping indication for the above mentioned.

A common alarm and fault relay shall be provided and the auxiliary switches of all the relays including the abovementioned, shall be wired to an easily accessible terminal block in the charger cabinet.

8.4 Installation

The units shall be properly bolted on floors where possible. The chargers shall be connected to the AC supplies.

The batteries shall be connected to the switchgear or light fittings where applicable, by means of PVC armoured cables unless otherwise specified.

C9 PADLOCKS AND LOCKING FACILITIES

1. Padlocks and locking facilities shall be provided to all panels and operating handles.
2. Padlocks shall be Brass 38mm, Union or Yale as approved equivalent manufacture
3. All padlocks shall be keyed alike per site. 3 keys shall be provided for each lock size and type.
4. Padlocks shall be divided into groups per project, per section, per substation or switchyard with master key facilities per group. 3 Master keys, which shall be numbered and labelled to correspond with their group, shall also be handed over.

C10 CABLE TERMINATIONS

1. Provide suitable cable end boxes and/or clamps to suit the final selection of cables.
2. Switchgear riser terminals shall be tinned. For cross-linked polyethylene insulated cables, provide suitable tinned lugs, bolts, nuts and washers.
3. For paper insulated cables, provide suitable cast-iron or sheet steel fabricated compound filling end boxes with the necessary flexible or copper bar connections between the riser terminals and end box terminals.
4. Cable end boxes shall have sealed stem bushings and shall be large enough to facilitate phasing out of cables. For cables larger than 120mm2, provide specially manufactured end boxes.

C11 DRAWINGS, LITERATURE, TUITION, SPARES AND TOOLS

11.1 Rating & Diagram plates

1. Provide rating and diagram plates on equipment in accordance with appropriate clauses of SABS, BS or IEC specifications. Diagram plates shall allow the internal connections of equipment where applicable especially for current transformers.
2. Provide rating and diagram plates on current transformers giving CT ratios, CT Class and knee point voltage where applicable, CT burden, connection instructions etc for various ratios.

3. Manufacture rating and diagram plates of mechanically strong, non-rusting, non-straining, non-discolouring and non-distorting durable material and secure with corrosion-free machine screws or rivets.
4. On dark surfaces, use white lettering on a black background. For danger notices, use red lettering on a white background. Indicate the three phases with red, white & blue. Colours shall be permanent and non-fading.

11.2 Shop drawings

1. For switchgear, submit technical literature including dimensioned drawings of plan and elevations. Wiring diagrams shall be provided for all switchgear panels.
2. The approval of drawings shall not relieve the manufacturer of his responsibility to the Engineer to supply the MV equipment according to the requirements of this Specification.

11.3 Tools and spares

1. Provide for each substation test prongs and one spare circuit breaker unit. Provide earthing equipment, testing equipment and jumpers.
2. In each substation provide a tool cabinet for housing tools, operating handles, spare fuses, and earthing and testing equipment.

11.4 Manuals and As Built drawings

1 3 sets of manuals shall be provided and shall include the following information:

- Manufacturers technical literature and operating instructions for circuit breakers
- Manufacturers technical literature and operating instructions for each type of protective relay and meter.
- Manufacturers technical literature for each type of CT and VT.
- Manufacturers technical literature and operating instructions for HV power factor correction.
- Recommended maintenance.
- Copy of type test certificates.
- Copy of factory test certificates.
- Copy of site test certificates.
- Copy of shop drawings comprising GA’s and wiring diagrams.
- Address and contact numbers for manufacturer and South African Agents for all equipment supplied under this contract.

C12 PAINT

HT switchgear shall be painted with the suppliers' standard colour.

C13 INSPECTION, TESTS AND COMMISSIONING

1. All MV equipment shall be inspected by the Engineer, on completion of manufacture, prior to despatch from the manufacturer's works. The MV equipment supplier shall advise the Engineer in good time, of such completion and acceptance.
2. MV equipment may only be delivered to site after inspection and approval by the Engineer. Such approval, however, shall not relieve the manufacturer of his responsibility for any deviation from the requirements of this Specification.
3. All the MV equipment shall be to the approval of, and shall comply with, the regulations of the Supply Authority and shall be the responsibility of the MV equipment manufacturer to establish and provide such requirements, and obtain approval where necessary.
4. The manufacturer shall perform tests in the factory as prescribed by SABS/BS and/or IEC specifications as well as the manufacturer's own standard routine tests on all materials, equipment and assemblies.
5. On completion of erection and installation on site perform all tests required by the Engineer to ensure the Works are ready for operation.
6. Provide sufficient oil or other coolant or insulant as required for the switchgear.
7. Switchgear tests shall include :
   - All mechanical operation tests;
   - All mechanical and electrical interlocks;
   - Checking of oil or gas filling, or of satisfactory vacuum;
   - Primary & secondary injection tests;
   - One minute pressure tests as follows :
     11kV switchgear = 24kV (r.m.s)
8. Cable tests shall include continuity tests of phase, any neutral, and earth conductors and armouring, and 15 minute pressure tests.
9. Submit written test reports to the Engineer.

C14 DRAWING SCHEDULE

Refer to attached Drawing Register Schedule for drawings issued as part of this RFQ.

SECTION D

TECHNICAL SPECIFICATION – DISTRIBUTION TYPE SUBSTATIONS

(Double Busbars)

D1 COMPLIANCE WITH REGULATIONS AND STANDARDS

1. The MV Switchgear shall comply with the latest revisions and amendments of the following :
    - The South African Bureau of Standards Code of Practice for the Wiring of Premises, SABS 0142-1987, referred to herein as the `Wiring Code'.
    - The Machinery and Occupational Safety Act of 1983 as amended.
    - The Municipal By-laws and Regulations and any regulations of the Supplier of Electricity.
    - The Local Fire Office Regulations.
    - Regulations of the Department of Posts & Telecommunications.
    - The applicable SABS Specifications and Codes of Practice or the BSI or IEC Specifications and Codes of Practice where no SABS Specifications or Codes of Practice exist.
    - The regulations of the local gas supplier where applicable.
    - The National Building Regulations SABS 0400 effective October 1988 as amended.
2. No claims for extras for failure of the Manufacturer to comply with any of the regulations and standards listed above will be considered.
3. Where conflict appears to exist between any of the regulations and standards listed above and the specification, refer such conflict to the Engineer in writing for his ruling.

D2 MATERIAL AND EQUIPMENT

1. All material and equipment shall conform in respect of quality, manufacture, tests and performance, with the requirements of the South African Bureau of Standards or where no such standards exist, with the relevant current Specification of the British Standards Institution.
3. All material and equipment shall be of high quality and suitable for the conditions on site. These conditions shall include weather conditions as well as conditions under which materials are installed, stored and used.
4. The manufacturer shall, where requested to do so, submit samples of equipment and material to the Engineer for approval before installation.

D3 GENERAL

3.1 General Detail and finishing

1. All indoor MV switchboards shall be of the indoor extensible metal clad type, provided with an integral flush-mounted instrument and relay panel associated with each breaker, switch or isolator panel unless otherwise specified or approved.
2. The Contractor shall also be responsible for the off-loading, erection, levelling and grouting of all switchgear and shall provide all the necessary tools, staging, lifting tackle, etc., for off-loading, handling and installation of the switchgear, and these items shall be removed from site when erection is completed. The switchgear shall be high voltage tested after erection.

3.2 Switchboards - General

1. Switchboards shall be laid out electrically and physically as specified or approved and shall be vermin proof and where possible, dust proof unless otherwise specified or approved. The housing shall be made from sheet metal steel having a minimum thickness of 2mm.
2. Switchboards shall be designed to allow for extensions as indicated on the drawings, and as specified.
3. Switchboard colour shall be as specified to SABS 1091 or as approved. All interior parts of switchboards shall be finished in white. All visible control switches, etc. shall be either black or chromium plated.
4. The layout of the panels shall be such that when facing the front of the board, the sequence of panels is as stated in the schedules and / or as indicated on the diagrams.
5. Cable boxes complete with all accessories and compound must be provided to suit cable sizes as specified. All cable boxes shall be arranged for bottom entry, unless otherwise specified or approved.
6. Available space for MV switchboards is indicated on the drawings. The Contractor must ensure that switchgear can fit into the available space, with proper allowance for working space behind and alongside boards and sufficient room in front of the boards to allow breakers to be racked out.
7. Each circuit shall be provided with individual cubicles so arranged that accidental contact with live metal in adjacent circuits is impossible.
8. It shall be possible to make off all cables of any circuit without exposure to any live conductors on the same circuit with the busbars energised.
9. On withdrawal of circuit breakers, all live parts must automatically be covered by shutters of robust mechanical design. Provision shall be made for padlocking these shutters in the closed position. Busbar shutters shall be clearly marked "busbars" in white lettering on red.
10. All panels shall be fitted with anti-condensation heaters each provided with an isolator suitable for 240V AC operation. Easily accessible terminals shall be provided on the boards where the 240 volt AC supply can be connected. The same supply shall be used for the DC tripping unit.
11. The Contractor shall be responsible for all the wiring and terminations.
12. Suitable cable boxes for MV cables and gland trays for LV cables shall be provided on all panels. Cable boxes shall be individually earthed to the earth bar.
13. All metal parts other than those forming part of electrical circuits shall be connected to an earth bar of 40mm x 4mm section run along the bottom rear of the switchboard. The earth bar shall be earthed at both ends of the switchboard to the substation earth bar. The earthing bar shall be in an accessible

position to allow for earthing of the cables. The Electrical Contractor shall ensure that the non-current- carrying parts, are connected to the earth bar either by means of their mounting arrangements on the panel or by means of a special earthing conductor fitted with lugs for attaching to the earth bar.

14. To minimise the effect of electrolysis, coils shall be so placed in the circuit that they are not connected to the positive pole of a battery except through normally open contacts.
15. Where a switchboard is made up of a number of units, some with relays or instruments and others without, all units without relays or instruments shall be fitted with blank panels to present a uniform appearance.
16. Where switchgear is provided with doors, they shall be provided with non-ferrous fasteners designed to draw the panel closed. The doors shall have at least three points of latching and shall be suitably reinforced to prevent distortion when open. Doors shall be lockable by means of a padlock.
17. Doors shall have stops to prevent overswing of the door when opening and to prevent interference with adjacent panels.

3.3 Type of Switchgear

1. The Contractor shall offer vacuum or SF_6 insulated switchgear, unless otherwise specified.
2. Full details of equipment offered shall be submitted at tender stage.

3.4 Characteristics of Switchgear

1	Number of poles	3
2	Type	As specified.
3	Rated Voltage	The switchgear shall be suitable for an earthed system for the rated voltages as set out in the project specification.
4	Rated impulse withstand voltage (peak):	75kV unless otherwise specified.
5	Fault rating	250MVA
6	Rated frequency :	50Hz unless otherwise noted.
7	Duration of short circuit:	3 seconds
8	Phase rotation :	Clockwise, Red-White-Blue, unless otherwise specified.

3.5 Busbars

1. Switchgear shall be double busbar type.
2. Switchgear shall be double busbar type.
3. All busbars and droppers shall be of suitable cross-section to comply with BS 159 with regard to temperature rise at the specified altitude and of sufficient mechanical strength for normal and fault conditions.
4. All busbars and connections shall be air insulated and shall be taped and / or shrouded on all straight sections and joints where possible and shall withstand the full power frequency test voltage.

5. All joints and tees in busbar connections shall preferably be made with shererised bolts, nuts and washers of not less than 12mm diameter. l0mm Diameter high tensile (black) bolts having a reference symbol "R" for the tensile range in accordance with BS970 will be accepted as an alternative. In this case proof of the tensile range shall be provided during the manufacture stage.
6. The design of busbars and the overlaps and joints in busbars shall conform to the applicable SABS specification and all joints shall be made with at least two bolts.
7. Busbars and connections shall be clearly colour-marked with the respective phase colours : Red, White, Blue.
8. The busbar chamber shall be completely vermin proof.
9. Busbars extending through fire walls shall be fitted with fire barriers and shall have a fire rating of at least 2 hours.

3.6 Impulse Withstand and Corona Levels

1. The complete switchboard assemblies shall withstand one-fifth microsecond volt wave with a peak value of 75kV successively at sea level conditions. Certified copies of test certificates issued by a recognised testing authority in this respect shall be submitted with the tenders.
2. The ends of the busbar chamber shall be blanked off with easily removable steel covers to allow for expansion of the switchboards.

3.7 Auxiliary Switches

1. Equipment shall be suitable for remote indication, auxiliary switches shall be provided to give the status of the switchgear.
2. Over and above the number of auxiliary switches specified above, two normally open and two normally closed spare auxiliary switches shall be provided.
3. All the auxiliary switches on each panel shall be wired to an easily accessible terminal block at the back of each panel.

3.8 Instrumentation and Lamp Indication

1. Metering instruments shall conform to the requirements specified herein. Metering instruments and lamp indication shall be provided as specified.
2. Where indicating lamps are supplied by the batteries, it shall be separately wired from the mechanism and tripping circuits to an easily accessible terminal block at the back of a panel.

3.9 Cable end boxes, clamps and terminations

1. Suitable cable end boxes and / or clamps shall be provided for the type(s) and sizes of cables as specified.

2. The Contractor shall ascertain from the Engineer before the manufacture of the panels the type and size of cable box to be used, depending of the choice of PILC cable or cross-linked polyethylene cable and copper or aluminium core cable.
3. The switchgear riser terminals shall be properly tinned.
4. Where cross-linked polyethylene cables are used, the switchgear manufacturer shall provide suitable tinned lugs, bolts, nuts and washers for the sizes of cables to be used.
5. Where paper insulated cables are used, the switchgear manufacturer shall provide suitable cast iron or sheet steel fabricated compound filling cable end boxes suitable for the sizes of cables to be used. The switchgear manufacturer shall also provide the necessary flexible or copper bar connections between the riser terminals and the cable end box terminals.
6. Cable end boxes with sealed stem bushings shall be provided. Cable boxes shall be large enough for phasing out cables. Special manufacture cable end boxes shall be used for cables larger than 120mm2

3.10 Earthing Arrangement

1. All switchgear shall be so constructed that it is possible to earth the cables. It must not be possible to earth the busbars under any circumstances.

3.11 Labelling

1. All switchgear shall also be provided with a similar label at the back of the panel. Where possible labels shall not be fixed to removable panels or doors.
2. All switchgear shall be provided with a manufacturer's label fixed in an easily accessible position inside the instrument panel showing the following data:
    - Fault capacity
    - Line Voltage
    - Maximum current carrying capacity of busbars
    - Maximum current carrying capacity of circuit breaker or isolator
    - Voltage transformer ratio (where applicable)
    - Current transformer ratio and Class (where applicable)
    - Manufacturer
    - Type and serial number

3.12 Anti-condensation heaters

1. Anti-condensation heaters shall be installed in the busbar and current transformer chambers.
2. The heaters shall be supplied from the voltage transformer or an external supply where this is available.

3.13 Panel Wiring

1. All panel wiring shall be PVC insulated and no insulated wire shall have less than three strands. The cross-sectional area of wires shall not be less than 2,5mm.

2. Each end of each wire or control cable connection shall be provided with a ferrule and a number corresponding to that on the diagram of connections.
3. Additional red ferrules marked "T" in white, must also be fitted on all wires associated with trip circuits.
4. All terminal blocks for current transformers, relay and instrument connections shall be neatly finished and readily accessible. Terminal strips which do not rely on pinch screws rotating on the wire strands shall be provided and full details and samples of the terminal strips proposed, shall be submitted to the Engineer for prior approval.
5. The design of the wiring cleats where used, shall be such that only limited pressure can be transmitted to the wires.

3.14 Cable Trench checker plate supports

Suitable adjustable treated angle irons shall be fitted to the bottom frame of switchgear to support the checker plates of indoor substation cable trenches.

3.15 Tools

1. If the design of switchgear is such that integral earthing of cables is not possible, then suitable earthing equipment shall be provided for each type of circuit breaker and isolator for each substation or switch room.
2. Suitable testing equipment and jumpers shall be provided for the switchgear for each substation where the design of switchgear requires such equipment.
3. At least two spring charging handles, operating handles and door keys shall be provided for each substation or switch room.
4. Wall mounted brackets shall be provided for carrying the manual, operating handles and test jumpers.
5. If special tools are required, a complete set of chrome finished case-hardened spanners and special wrenches to fit every nut and bolt on the equipment supplied, shall be provided under this contract. Any special tools or keys that may be required for effecting adjustments of parts as well as all standard earthing and test equipment, shall also be provided.
6. These tools shall be accommodated in suitable, neat, properly designed, wall constructed steel equipment board with the tool positions marked. The board shall be capable of being locked by means of a padlock.
7. A fully detailed list of tools shall be supplied before delivery.
8. The tools shall not be used for the erection of the contract works.

3.16 Spare Fuses and Lamps

One spare fuse shall be provided for each LV fuse used on the switchgear. Two spare lamps shall be provided for each lamp type used on the switchgear. The spare lamps and fuses shall not be used by the Contractor.

D4 CIRCUIT BREAKERS

4.1 General

All circuit breakers shall be of the triple-pole , vertical or horizontal isolation, draw-out truck type, fitted on separate frame with wheels.

4.2 Ratings

1. The circuit breakers shall be capable of carrying the normal currents as specified at the site altitude.
2. The circuit breakers shall be capable of interrupting the symmetrical and asymmetrical fault currents and also making and latching against the current stated on the schematic drawings at the minimum voltage specified.
3. Each circuit breaker shall be clearly marked to show the current and MVA ratings to which the breaker has been satisfactorily tested.

4.3 Operating Mechanisms

1. Circuit breakers shall be provided with spring operated mechanisms with hand spring charging, or solenoid mechanisms as specified.
2. Spring and solenoid operated switchgear shall be provided with electrical control switches on the instrument panels for local closing and tripping as specified.
3. The total break times measured from the instant of energising the trip coil to final arc extinction shall be less than 100ms.
4. An approved method for locking the control switches in the neutral position shall be provided.
5. The circuit breakers shall be fitted with an electrical tripping push button mounted on the instrument panel.
6. If motor wound spring mechanisms and/or solenoid mechanisms are offered, then the Contractor must ensure that suitable batteries with sufficient capabilities are provided to supply the motors and/or solenoids respectively.

4.4 Anti-pumping

1. All circuit breakers shall be of the trip-free type and means shall be provided to prevent pumping while the closing circuit remains energised and the breaker either fails to latch or trips during closing due to the operation of the protective relays. The arrangement shall be to the approval of the Engineer.
2. Where anti-pumping relays are provided, they shall be continuously rated.

4.5 Closing Devices

1. All electrically operated closing devices shall be at least suitable for operation at any voltage between 100 percent and 80 percent of the nominal control voltage at the device terminals . The maximum and steady state current at nominal voltage required by each closing device shall be stated in the Schedules.
2. All operating coils of closing coil contactors, shall be continuously rated. The contacts, however, may be short-time rated.
3. The closing coil circuit shall be provided with a normally closed auxiliary contact which opens when the circuit breaker is latched closed, so as to prevent repeated closing signals being given to the coil.
4. Circuit breakers and contactors shall be fully interlocked such that it will not be possible to withdraw, lower or plug the units in before it is tripped. It must not be possible to close the unit before it is fully plugged in or fully withdrawn to the “test”, “service” or “earth” positions. It shall also be fully interlocked against any other maloperation that might be possible and peculiar to the type of equipment offered. It shall be sufficiently interlocked to make it completely safe for operation by personnel not familiar with the equipment.

4.6 Tripping Devices

1. All electrical tripping devices shall be of the shunt type suitable for operation at any voltage between 120 percent and 80 percent of the nominal voltage at the device terminals. The maximum and steady state current at nominal voltage required by each tripping device shall be stated in the schedules.
2. The tripping devices of a circuit breaker, when the circuit breaker is not carrying current, shall be capable of operating satisfactory down to 50% of the nominal auxiliary supply voltage measured at the device terminals.
3. A normally-open contact operated by the breaker mechanism shall be placed in series with the trip coil and shall be capable of interrupting the maximum trip coil current.

4.7 Indicating Services

1. A mechanical indicating device to show whether the breaker is open or closed shall be provided. The device shall be labelled ON and OFF and shall be clearly visible from the front of the panel.
2. A mechanical indicator shall also be provided to indicate whether the breaker is racked in or out.
3. All mechanical indications shall be clearly visible from the front of the panel, otherwise additional electrical indication shall be provided.
4. In all cases positive indication must be provided.
5. All circuit breakers shall be clearly marked to indicate the correct panel into which each unit should be plugged.

4.8 Isolating Devices

1. Circuit breaker spouts and sockets shall be such that all circuit breakers of similar type and current rating shall be interchangeable. It shall not be possible to insert a circuit breaker into a higher rated circuit.
2. All fixed portions of isolating devices and connections thereto shall be of the same current rating as the associated circuit breaker.
3. Automatically operated shutters shall be provided so that on withdrawal of the circuit breaker spouts, these shutters cover the sockets automatically to prevent inadvertent contact with live busbars.
4. Facilities shall be provided for padlocking the circuit breakers in the "racked in" and "racked out" position and also the spout shutters.
5. With units withdrawn to the "test" or "service" position , provision shall be made for reconnection of the auxiliary circuits for testing purposes. In cases where this necessitates the use of a separate jumper plug or other arrangement, the contract price shall include for the supply of at least one such jumper plug or other device per separate switchboard.

4.9 Mechanical Interlocks and Safety Shutters

1. The following minimum interlocks are required:
   - It must not be possible to raise, lower or withdraw the circuit breaker unless tripped.
   - It must be impossible to close the circuit breaker unless it is either fully plugged-in, fully withdrawn or earthed.
   - It must be impossible to plug the circuit breaker or to close it unless the truck is properly secured.
   - On withdrawal of circuit breakers, all live parts must automatically be covered by substantial vermin-proof shutters. Shutters shall be provided with means for padlocking in the closed positions.
   - In instances where the control and protection circuits are connected by multicore cable and a plug to the circuit breaker mechanism contacts, additional interlocking is required to prevent the circuit breaker being closed in the operating position without the protection circuits being connected.
2. All safety shutters shall be clearly and indelibly labelled in letters of the largest practical size, indicating the live apparatus screened off by the shutters.

4.10 Relays

1. Each circuit breaker shall be fitted with protection and auxiliary relays as specified on the drawings and schedules.
2. Where the circuit breaker is to be equipped for remote indication and control, all the relay auxiliary switches shall be wired to an easily accessible terminal block on the back of each panel.

3. Solid state relays shall be provided. Allowance shall be made for additional terminal blocks on every panel for testing purposes. Combined solid state overcurrent and earth fault relays must be equipped with indicating flags showing the cause of the tripping either earth fault or overcurrent.

4.11 Auxiliary Switches

1. Circuit breakers shall be provided with sufficient direct auxiliary contacts to suit the circuits served. In addition , at least four spare contacts shall be provided. These spare contacts shall be readily convertible from normally-opened to normally-closed operation and shall be completely wired to an accessible terminal board adjacent to the outgoing control cable termination.
2. Auxiliary contacts shall be coupled in such a manner as to follow positively the operation of the switching device concerned and no slave relays shall be used to provide additional contacts. Means shall be provided for adjusting the auxiliary contacts relative to the operating mechanism.
3. Where insufficient contacts are available a slave relay shall be provided but shall be used for indication only.

4.12 Circuit Breaker Truck Connections

Where the auxiliary control connections between the circuit breaker truck and the fixed housing are made by means of flexible connections, these shall be contained in a flexible tube. If metallic flexible tubing is provided this shall be PVC covered to the Engineer's approval.

D5 ISOLATORS AND SWITCHES

All isolators and switches shall be of identical construction to the circuit breakers specified above but without protection.

D6 TESTING

6.1 Type testing

Type Tests shall be carried out on each switchgear type to be installed. Manufacturer’s type test will be acceptable.

6.2 Routine Testing

Routine tests shall be made on all switchgear at the manufacturers works to ensure that the equipment complies in every respect with the operational requirements and the applicable standard specification.

6.3 Site Tests

Switchgear shall be impulse and operation tested on site prior to commissioning and as specified.

D7 INSTALLATION AND ERECTION

7.1 Alignment and Fixing of Switchgear

7. All indoor switchgear panels shall be properly aligned, erected, plumbed, bolted together and fixed onto the floor.
8. If the floor is not level, suitable packing shall be used to level the switchboard.
9. The contractor shall ensure that switchgear can be freely operated without any physical obstruction after the switchgear has been placed in position.
10. Each individual panel shall be levelled before the panels are bolted together.
11. The panels shall be assembled and erected strictly in accordance with the manufacturer's instructions.
12. Switchgear trucks shall move freely and shall be properly aligned.

D8 TRIPPING BATTERIES AND TRICKLE CHARGERS

8.1 General

1. The trickle chargers and battery cabinets shall be enclosed in an adequately ventilated steel enclosure.
2. Each set or bank of batteries shall be provided with a separate battery charger.
3. Each set or bank of batteries shall be housed in a separate self-contained floor-standing metal-clad cabinet as one unit.
4. The battery charger shall be connected to a terminal block at the back of the switchgear panel by means of PVC cable and shall be supplied from the voltage transformers.
5. No fuses or circuit breakers shall be installed in the trip circuits from the batteries to the switchgear panels.
6. The sizes of the AC and DC cables between the battery unit and switchgear panels shall be suitable for the loads of the equipment. The cost of the cables shall be included in the price for the supply of the battery unit.
7. Where lights are specified on switchgear and control panels to be supplied from the batteries, the supply to the lights shall be separated from the mechanism and tripped circuits by means of a separate cable to be installed to the switchgear or control panels.

8.2 Batteries

1. Where spring charging motor and solenoid mechanisms are used, 110V battery sets shall be provided for the supply of the mechanisms as well as for tripping and closing coils. 110V or 32V battery sets shall be provided.
2. Where lights are specified on switchgear and control panels to be supplied from the batteries, the supply to the lights shall be separated from the mechanism and tripped circuits by means of a separate cable to be installed to the switchgear or control panels.

3. The battery sets offered shall be fully capable of providing the load requirements of all motors, lamps, relays, coils, etc.
4. The battery sets shall be capable of providing the full standing load of all associated equipment during complete failures of the AC supply, for a minimum period of 6 hours, after which period it shall be possible to open and close all circuit breakers once in rapid succession.
5. The cells shall be so arranged that the electrolyte is clearly visible and the batteries easily maintained.
6. All batteries shall be of sealed type, unless otherwise specified.

8.3 Charging Equipment

Rectifier

1. The unit shall comprise a solid state type rectifier with a double wound transformer.
2. The output voltage shall not vary more than 1% in variations of 10% of the input voltage at ambient temperature ranges at the site.
3. The charger shall be of the constant voltage control type with a higher (booster) and lower (trickle) rate of charge. The higher rate of charge shall be such as to completely charge a fully discharged battery in a period of 15 hours.
4. The capacity of the charger shall be such that it can provide the full standing load plus battery charging current.

Instruments

The following instruments are required:

- DC ammeter for charging current
- DC voltmeter for battery voltage
- Loose voltmeter to measure cell voltage.

Indication Lights

An indication light is required to indicate each of AC supply healthy and common fault.

Switches and Fuses

The following switches and fuses are required:

- A main switch to isolate the AC input
- Fuses on the DC and AC sides except in the trip circuits of the switchgear.

Control of the Charge Rate

The charge rate shall be automatically controlled.

Protection and Alarms

If a standing load is to be supplied to switchgear and control panels then the following protection systems with alarms shall be provided to trip the standing load supplied:

- AC supply fail relay with time delay

- DC under-voltage relay with 90% setting

Tripping indication for the above mentioned.

A common alarm and fault relay shall be provided and the auxiliary switches of all the relays including the abovementioned, shall be wired to an easily accessible terminal block in the charger cabinet.

Installation

The units shall be properly bolted on floors where possible. The chargers shall be connected to the AC supplies.

The batteries shall be connected to the switchgear or light fittings where applicable, by means of PVC armoured cables unless otherwise specified.

D9 PADLOCKS AND LOCKING FACILITIES

1. Padlocks and locking facilities shall be provided to all panels and operating handles.
2. Padlocks shall be Brass 38mm, Union or Yale as approved equivalent manufacture
3. All padlocks shall be keyed alike per site. 3 keys shall be provided for each lock size and type.
4. Padlocks shall be divided into groups per project, per section, per substation or switchyard with master key facilities per group. 3 Master keys, which shall be numbered and labelled to correspond with their group, shall also be handed over.

D10 CABLE TERMINATIONS

1. Provide suitable cable end boxes and/or clamps to suit the final selection of cables.
2. Switchgear riser terminals shall be tinned. For cross-linked polyethylene insulated cables, provide suitable tinned lugs, bolts, nuts and washers.
3. For paper insulated cables, provide suitable cast-iron or sheet steel fabricated compound filling end boxes with the necessary flexible or copper bar connections between the riser terminals and end box terminals.
4. Cable end boxes shall have sealed stem bushings and shall be large enough to facilitate phasing out of cables. For cables larger than 120mm2, provide specially manufactured end boxes.

D11 DRAWINGS, LITERATURE, TUITION, SPARES AND TOOLS

11.1 Rating & Diagram plates

1. Provide rating and diagram plates on equipment in accordance with appropriate clauses of SABS, BS or IEC specifications. Diagram plates shall allow the internal connections of equipment where applicable especially for current transformers.
2. Provide rating and diagram plates on current transformers giving CT ratios, CT Class and knee point voltage where applicable, CT burden, connection instructions etc for various ratios.

3. Manufacture rating and diagram plates of mechanically strong, non-rusting, non-straining, non-discolouring and non-distorting durable material and secure with corrosion-free machine screws or rivets.
4. On dark surfaces, use white lettering on a black background. For danger notices, use red lettering on a white background. Indicate the three phases with red, white & blue. Colours shall be permanent and non-fading.

11.2 Shop drawings

1. For switchgear, submit technical literature including dimensioned drawings of plan and elevations. Wiring diagrams shall be provided for all switchgear panels.
2. The approval of drawings shall not relieve the manufacturer of his responsibility to the Engineer to supply the MV equipment according to the requirements of this Specification.

11.3 Tools and spares

1. Provide for each substation test prongs and one spare circuit breaker unit. Provide earthing equipment, testing equipment and jumpers.
2. In each substation provide a tool cabinet for housing tools, operating handles, spare fuses, and earthing and testing equipment.

11.4 Manuals and As Built drawings

3 sets of manuals shall be provided and shall include the following information:

- Manufacturers technical literature and operating instructions for circuit breakers
- Manufacturers technical literature and operating instructions for each type of protective relay and meter.
- Manufacturers technical literature for each type of CT and VT.
- Manufacturers technical literature and operating instructions for HV power factor correction.
- Recommended maintenance.
- Copy of type test certificates.
- Copy of factory test certificates.
- Copy of site test certificates.
- Copy of shop drawings comprising GA’s and wiring diagrams.
- Address and contact numbers for manufacturer and South African Agents for all equipment supplied under this contract.

D12 PAINT

HT switchgear shall be painted with the suppliers' standard colour.

D13 INSPECTION, TESTS AND COMMISSIONING

1. All MV equipment shall be inspected by the Engineer, on completion of manufacture, prior to despatch from the manufacturer's works. The MV equipment supplier shall advise the Engineer in good time, of such completion and acceptance.
2. MV equipment may only be delivered to site after inspection and approval by the Engineer. Such approval, however, shall not relieve the manufacturer of his responsibility for any deviation from the requirements of this Specification.
3. All the MV equipment shall be to the approval of, and shall comply with, the regulations of the Supply Authority and shall be the responsibility of the MV equipment manufacturer to establish and provide such requirements, and obtain approval where necessary.
4. The manufacturer shall perform tests in the factory as prescribed by SABS/BS and/or IEC specifications as well as the manufacturer's own standard routine tests on all materials, equipment and assemblies.
5. On completion of erection and installation on site perform all tests required by the Engineer to ensure the Works are ready for operation.
6. Provide sufficient oil or other coolant or insulant as required for the switchgear.
7. Switchgear tests shall include :
   - All mechanical operation tests;
   - All mechanical and electrical interlocks;
   - Checking of oil or gas filling, or of satisfactory vacuum;
   - Primary & secondary injection tests;
   - One minute pressure tests as follows :
     11kV switchgear = 24kV (r.m.s)
10. Cable tests shall include continuity tests of phase, any neutral, and earth conductors and armouring, and 15 minute pressure tests.
11. Submit written test reports to the Engineer.

D14 DRAWING SCHEDULE

Refer to Drawing Register.

SECTION E

LV RETICULATION INFRASTRUCTURE – DETAILED SPECIFICATION

All cabling will be installed in cable trenches and through PVC sleeves at road crossings.

E1 LV CABLING

Main LV cabling to will be provided in accordance with CoT standards and SANS. All LV cable terminations shall be the heat shrinkable type. All cabling will be installed in cable trenches and through PVC sleeves at road crossings.

E2 LV CABLE TRENCHES AND INSTALLATION

LV cable will be laid on 100mm sifted sand and covered with 100mm sifted sand topping. LV cables to be installed a minimum of 600mm below finished level. All trenches are to be backfilled and compacted in 150mm layers to 91% MOD ASHTO with compaction test results being forwarded to the Electrical Engineer for approval.

E3 CABLE ROUTE MARKERS

LV cable route markers shall be provided every 500m and when the route changes direction. The cable markers shall be encased in concrete and shall be buried at least 300mm below the finished surface and shall protrude by at least 250mm.

E4 EARTHING

Earthing to the LV network reticulation will be in accordance with SANS 10142-1 requirements and CoT standards and specification.

SECTION F

PUBLIC AREA LIGHTING INFRASTRUCTURE – DETAILED SPECIFICATION

F1 STREET AND PUBLIC AREA LIGHTING INFRASTRUCTURE

Street lighting will be installed to all streets within the proposed development in accordance with SANS 10098. Public area lighting will consist of concrete poles of 9m mounting height fitted with LED floodlight fittings fed from a 500 kVA miniature substation on Erf 2 via underground cables.

A detailed street lighting layout is included in the will consist of concrete poles of 9m mounting height fitted with LED streetlight fittings fed from the distribution kiosks with underground cables.

The streetlighting system provides for a 9m steel pole & 3m double outreach with luminaires as per the bills of quantities. The average spacing between poles approximates to 35m. The proposed streetlighting cables have been rated to cater for future extensions. The bills of quantities allows for 3 options.

F2 ANTI-THEFT : PROTECTOR THEFT LOOP

Supply & install a continuous 32mm ø HDPE sleeve from the end start to the end of the streetlight poles.

F3 CABLE RETICULATION

Streetlighting shall be reticulated via 25mm^2 4c PVC/Cu cables with a 16mm^2 BCEW cables fed from the local miniature substation and controlled by a day/night photocell.

F4 DESIGN APPROVAL

Before the commencement of construction all designs for the electrical supply network are to be approved by the CoT.

SECTION G

EARTHING AND LIGHTNING PROTECTION SYSTEM – DETAILED SPECIFICATION

G1 EARTHING

A main earthing system will be provided to the entire MV and LV reticulation system in accordance with SANS requirements to CoT standards and specifications. This will include earthing to each miniature substation and all MV switchgear and bonding of the earthing network to the LV reticulation system.

G2 STRUCTURAL LIGHTNING PROTECTION SYSTEM

Structural lightning protection will be provided to the Consumer substation building in accordance with SANS requirements.

SECTION H

COMMUNICATIONS SYSTEM – DETAILED SPECIFICATION

H1 INTRODUCTION

The Tshwane Automotive Special Economic Zone (TASEZ) Fibre Expansion project is focused on developing the concept design for the expansion of the existing fibre optic infrastructure within Phase1 to the Phase 2 precinct. It will also expand the infrastructure to cater for a residential component via a PON (Passive Optical Network) which will be fed from the expanded fibre network from phase 1. The additional fibre infrastructure will also provide capacity for Security (street surveillance).

With the expansion of the Fibre network, the project will also be responsible for the relocation of the temporary distribution cabinet located outside the new Data Centre. The new location for the distribution cabinet will be inside the new Data Centre. In addition to this, all-existing concrete manholes will be upgraded to a more secure and IP rated chamber to protect against vandalism and water ingress.

H2 REFERENCES

The following referenced documents are used for the purpose of this Technical Specification. Further information on currently valid national and international standards can be obtained from the SANS Standards Division.

IEC 60794-5, *Optical fibre cables - Part 5: Sectional specification - Micro duct cabling for installation* by blowing

IEC/TR 62691, *Optical fibre cables - Guide to the installation of optical fibre cables*

SANS 10198-8, *The selection, handling and installation of electric power cables of rating not exceeding 33 kV – Part 8: Cable laying and installation.*

SANS 10340-2*, Installation of telecommunication cables – Part 2: Outdoor fibre optic cables.*

SANS 60793-1-40/IEC 60793-1-40: 2001, *Optical fibres – Part 1-40*: *Measurement methods and test procedures – Attenuation*

ISO 4892-3, Plastics – Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps.
SANS 1411-6, Materials of insulated electric cables and flexible cords – Part 6: Armour.

SANS 1411-7, Materials of insulated electric cables and flexible cords – Part 7: Polyethylene (PE).
SANS 60793-2-50/IEC 60793-2-50, Optical fibres – Part 2-50: Product Specifications – Sectional specification for class B single-mode fibres.

SANS 60793-2-10/IEC 60793-2-10, Optical Fibres - Part 2-10: Product Specifications – Sectional

specification for category A1 multimode fibres.

SANS 60794-1-2/IEC 60794-1-2, Optical fibre cables – Part 1-2: Generic specification – Basic optical cable test procedures.

TIA 598-C, Optical fibre cable colour coding.

H3 SPECIFICATIONS

Micro Blown Cable

Description

Micro Blown Cables are designed to be used with the Micro duct systems and installed using a blowing machine for long installations. It is constructed of Fibres inside multiple gel filled loose tubes which range from 12 fibre to 288 fibre cable. The cable is strengthened by a glass reinforced plastic (GRP) strength member with a high-density polyethylene outer sheath.

The exterior is UV stabilized with a 2.5% evenly dispersed carbon black. This construction gives maximum flexibility while isolating the Fibres from installation and environmental rigors. UV stabilized with a 2.5% evenly dispersed carbon black.

Cable Structure

- Thixotropic jelly filled loose tube design.
- Tubes SZ stranded around the central strength member.
- Water blocking yarns and tape are applied for cable core water ingress protection.
- Over sheathed with Black HDPE.
- One ripcord laid beneath the sheath.

Characteristics

- Fibre attenuation at 1310/1550nm: ≤0.35/0.21db/km.
- Fibre linear PMD: ≤0.06ps/√km (M=20, Q=0.01%).
- Installation tensile resistance: 1.2 times cable weight, not less than 600N.
- Crush resistance: 650N.
- Water penetration: 3m sample, 1m water column, for 24h.
- Cable print: MBC, fibre count, fibre type, HFCL, production date, cable ID number, meter count.
- Fibre count – 144F
- Number of fibres per tube – 24 Glass fibre
- Number of loose tubes – 6 PBTP
- Number of Fillers - 0
- Central Strength Member – 2.2mm PE up to coated to 3.2mm

- Moisture Barrier – Over FRP Rod + Core, water swellable yarn
- Outer Sheath – 0.5
- Number of Ripcords - 1
- Cable Diameter – Approx. 8.0mm
- Cable Weight/km – Approx 55 Kg/Km

Colour Code for Fibre and Tubes

Fibre Terminations

Description

Dome Fiber Optic Splice Closure is used in aerial, buried applications, wall-mounting applications, for the straight-through and branching splice of the fibre cable. The device allows for direct jointing and bifurcated jointing. It also protects fibre optic splices from the elements while providing fast and easy no-cost re-entry.

Features

- Will be used in straight-through and branch application for cables of bunchy fibre and ribbon fibre.
- Engineering plastic body filled with silicone rubber and sealed with hoop; the entry ports are sealed with mechanical screw thread. Enclosures will be IP68 rated
- Quick open clamped dome-base design
- Mechanical design suitable for installing, fibre splicing storage and cable connection
- Slide and lock fibre optic splice tray with its opening angel above 90 degrees.

Specifications

- Material: PC
- Dimension (mm): 160×420
- No. of Cable Inlet/Outlet: 4
- Number of Fibres per Tray: 12 or 24 core
- Max. Number of Trays: 6 or 12
- Max. Number of Fibres: 144 or 288

Telco Manholes

Description

Telecom manhole covers (also referred to as utility or telecommunication manhole covers or access chambers) provide access points to underground telecommunication infrastructure with protection, making access easier.

Telecom manhole covers serve multiple functions; for instance: they protect access points by covering them at critical access points while offering multiple levels of protection at entry and exit points for underground communications infrastructures; secure underground cables against damage while offering quick exit when entering underground facilities for maintenance work or emergencies.

They will safeguard sensitive telecom equipment and cabling against environmental elements like rainwater, debris and physical damage; furthermore, they block unauthorised entry to these essential facilities. All Manholes will be IP65 or higher.

Manhole covers come equipped with locking mechanisms designed to restrict unauthorised entry and stop any attempted tampering with them. The access chamber solution fully addresses all functional requirements for the deployment in telecommunications and utility infrastructure applications required at TASEZ.

Features

- Will be manufactured from high strength light weight compound for one person operation
- Corrosion & UV Resistant
- Knock out duct entries
- Lockable lid
- Integrated GLAM electronic locking solution
- Integrated slack management brackets
- Impact resistant
- No scrap value
- Modular design will allow for more challenging installation requirements should the need arise
- Dolomite compliant chambers can be ordered and certified should we require this.
- Can be utilised in existing and/or newly built route.

Passive Optical Network (PON)

Overview

A passive optical network (PON) is a telecommunications technology used to provide fibre to the end consumer, both domestic and commercial. A PON's distinguishing feature is that it implements a point-to-multipoint architecture, in which unpowered fibre optic splitters are used to enable a single optical fibre to serve multiple endpoints. The endpoints are often individual customers, rather than commercial. A PON does not have to provision individual fibres between the hub and customer. Passive optical networks are often referred to as the "last mile" between an ISP and customer.

GPON stands for Gigabit Passive Optical Networks. GPON is a point-to-multi point access mechanism.
Its main characteristic is the use of passive splitters in the fibre distribution network, enabling one single feeding fibre from the provider's central office to serve multiple homes and small businesses.
GPON uses the Advanced Encryption Standard (AES) for security purpose, which was designed to be efficient in both hardware and software, and supports a block length of 128 bits and key lengths of 128, 192 and 256 bits. GPON also supports all types of Ethernet protocols.

A GPON network consists of OLT (Optical Line Terminals), ONU (Optical Network Unit), and a splitter. The splitter will divide the signal when needed. The OLT takes in all the optical signals in the form of beams of light from ONUs and will convert it to an electrical signal.

GPON gives the end user the ability to consolidate multiple services onto a single fibre transport network. This technology reduces costs and infrastructure while increasing bandwidth. It provides 2.5 GB/s of downstream bandwidth and 1.25 GB/s upstream divided by the split ratio to each customer delivering a customisable, high-capacity fibre network for forms of IP based services.

Civil Requirements

General

The requirements of this part and SANS 10198-8 are applicable to the civil works associated with the installation of ducts and direct-buried cables. This part shall be used in conjunction with the installation procedures laid down by the duct and optical fibre cable manufacturer. In case of a dispute, the duct and optical cable manufacturer's procedure shall apply.

The duct shall be made of HDPE. It shall also be coloured and marked as specified. The size of duct shall be 7-way duct.

Preparatory work

To ensure integrity of the duct, trenches and manholes for the later installation of the fibre-optic cable, an upfront analysis shall be done to ensure that the duct, trenches, manholes and installation procedures are documented.

The installer shall ensure that he/she is aware of the position of all services that could be encountered during the civil works, for example water and gas pipes, electric and telecommunication cables.

The installer shall ensure that any wayleaves or permission from private property owners necessary for the civil works to proceed are in place.

All surfaces, unless otherwise specified, necessarily disturbed in the execution of the works shall be restored by the contractor on completion of the works. Surfaces shall be left in as near original condition as possible and the contractor shall be responsible for maintaining the surface in a usable condition until restoration is

complete.

Trenches

Trenches shall be dug by hand (pick and shovel) or by mechanical means (trenching machinery). When trenching in the vicinity of power cables, mechanical means shall not be used within 3 m of any existing service.

Classification of ground conditions

Soft and pickable

This type of ground includes all materials that can be excavated by means of pick and shovel, a trenching machine or an excavator, without the use of an independent compressor or pneumatic rock breaking equipment or independent hydraulically operated rock breaking equipment.

Hard rock

This type of ground includes all materials that cannot be excavated by a trenching machine or an excavator without blasting, wedging or splitting or, with the use of an independent compressor or pneumatic rock breaking equipment or independent hydraulically operated rock breaking equipment, prior to removal.

Blasting of rock

The blasting of rock shall only be allowed if approved by the relevant authorities in CoT.

Trench width and depth

The width and depth of the trenches for the installation of ducts or direct-buried cables shall be as specified. The depth of the trench should be such that the distance from the top of the duct to the warning tape shall be at least 300 mm.

Trench floor

The floor of a trench shall offer a firm base such as compacted soil and be free of stones. If rocks or stones are present, then a 150 mm layer of compacted bedding soil shall be added. Bedding soil may be obtained by sifting the excavated material (if suitable) using a sieve having a 12 mm (max.) mesh size. Alternatively, suitable bedding soil may be imported and shall comply with the relevant environmental permit requirements.

Back-filling of trenches

Once the duct(s) or direct-buried cable has been installed (see 5.6 and 5.8), they shall be covered with a 250 mm layer of compacted blanket soil. Blanket soil may be obtained by sifting the excavated material (if suitable) using a sieve having a 12 mm (max.) mesh size. Alternatively, suitable bedding soil may be imported. Only hand compaction tools shall be used to compact the blanket soil. When the remainder of trench is back-filled, compacting machinery shall be employed. For cable trenches in roadway zones, back-filling shall comply with local road agency requirements.

Manholes

The manholes shall be constructed from composite material as per specification with a reinforced concrete plinth and shall be pre- manufactured.

The size of the manholes shall be as specified by the customer.

The type of lids/covers used on the manholes shall be as specified by the customer.

The depth of the lid/cover relative to ground level, for example, at ground level or below ground level shall be specified by the customer.

The distance between manholes shall be determined by the method of installation of the duct cable.

Installation

Pre-installation procedures

Before installation commences, the installer shall carry out the following checks:

- Establish that the routes defined in the installation specification are accessible and available in accordance with the installation program.
- Establish that the environmental conditions within the routes and the installation methods to be used are suitable for the design of duct and optical cable to be installed.
- Advise the customer of all proposed deviations and handover the proposed line route diagram.
- Determine any measures necessary to prevent the optical fibre within the optical cable from experiencing direct stress following installation.
- Ensure that all necessary installation accessories are available.
- Identify proposed location of cable closures and establish their accessibility and availability in accordance with the installation program.
- Determine the proposed locations at which drums (or reels) are to be positioned for the installation program and establish the accessibility and availability at those locations.
- Storage and transportation of drums shall be according to the manufacturer's recommendations.

The cable closures shall be positioned such that subsequent repair, expansion or extension of the installed cabling may be undertaken safely and with minimal disruption.

Pulling-in Rope Connection and Overload Protection

The cable/duct connection to the pulling-in rope shall be made using factory or field fitted pulling eyes or by using cable grips or socks.

To reduce twisting during installation, the pulling end of the cable/duct shall be connected to the end of the pulling-in rope via a twist compensation device, for example, a rotary shackle or a rope socket with a swivel.

There are two classes of devices that provide the overload protection for the cable: those situated at the primary or intermediate winch and those at the cable/rope interface. Devices at the winch include

(depending on winch type) mechanical clutches, stalling motors and hydraulic bypass valves which can be set to a predetermined load and the dynamometer/cable tension monitoring type systems to provide feedback for winch control. Devices at the cable/rope interface include mechanical fuses (tensile or shear) and sensing devices to provide winch control information. All these systems have a common aim of limiting or stopping the winching operation when loads applied on the cable approach a damaging level.

Bending, Guiding System and Rollers

To avoid subjecting cables/ducts to unacceptable bending stresses, the manufacturer's recommendations regarding bending diameters shall be observed during pulling and installation. Guiding equipment shall be used at bends in the route and at duct entrances so that the minimum- bending diameter recommended for the particular cable type/duct is observed.

Bending optical fibre cable under tension during installation shall be undertaken with care. Guiding systems and equipment shall be examined for their suitability of purpose and the cable manufacturer's stated bending criteria shall be carefully considered.

NOTE: In general, a minimum-bending diameter of around 20 times the cable diameter is considered appropriate, but when being installed under tension, it is suggested that this ratio may be doubled. Most guiding equipment can be used for both optical fibre and metallic cables but long length placing may require many guiding elements and they should all have the properties of lightness and low friction.

When pulling ducts/cable into trenches, the cable/duct shall be protected from damage due to dragging along the trench bottom or sides by the use of rollers. On long length pulls, the number of rollers used shall be taken into account when deciding on the frictional drag that these will impart to the cable/duct.

Cable Friction and Lubrication

Special attention shall be paid to friction and lubrication when installing optical fibre cables. The friction forces that should be overcome are related to several factors, primarily the materials and finishes of the cable sheath, duct, pulling-in rope or line and guiding components, and all can contribute significantly to the total installing force required. Lubrication can have beneficial effects in reducing the total installing force needed and attention shall be paid to both the rope and cable/duct end interfaces and steps taken to ensure that the cable/duct attachment point presents a smooth profile. Any lubrication system employed shall have a long-term compatibility with cable, rope and duct material and be safe from an occupational health point of view. Suitable lubrication as recommended by the manufacturer shall be used.

Underground Cable Installation in Ducts by Blowing

The distance a cable can be blown will depend on many factors and all need to be considered when deciding what method is the best for the particular route. The factors influencing the blow distance are as follows:

- Cable weight (the heavier the cable the shorter the distance)
- Cable/duct area ratio (the larger this is the shorter the distance)
- The shape and the length of the route (the more bends and inclines the shorter the distance)

- Compressor size and air condition (too small a compressor the shorter the distance, the wetter the air the shorter the distance, the drier the air the shorter the distance)
- Cable and duct material (friction)
- Cable construction (the more flexible the cable the shorter the distance)
- The ambient conditions

Usually the smaller the duct diameter, the lower the airflow rate and the shorter the installation length will be for a specific cable design.

For ambient conditions above 30°C, it is highly recommended to use an air cooler inserted between the compressor and the blowing system.

Installation of Direct-buried Cable

Installation methods

Normal buried cable installation methods including ploughing (direct, vibratory or winched), trenching and moiling can, in general, be used for direct burial of optical fibre cable provided that the cable is specifically designed for this type of application. The same depth of cover as for metallic cables is usually adequate but traffic capacity or other considerations of security may indicate a requirement for greater depth. Where a trench method is used, backfilling materials and practices may require particular consideration so that fibre strain limits are not reached during this operation.

Cables in trenches

When installing cables in trenches, the following precautions shall be observed:

- The direct burial of cables under roadways in the longitudinal direction is permitted only in exceptional cases. At the crossings of roadways or installations longitudinally under roads, cables shall be protected by cable pipe ducts encased in 150 mm 15 MPA concrete.
- When cables run almost parallel to a road, the ducts between trenches shall cross the roadway at an angle of about 45°in order to reduce the pulling forces.
- When the cable trench is free of obstacles and where local conditions allow, the cables can be unrolled from the cable transport trailer driven along the trench and laid in the trench.
- The unrolling of the cable from the drum shall correspond to the forward movement of the vehicle and a suitable braking device can ensure that not too much cable is unrolled. As it is unrolled, the cable shall be moderately tensile loaded, in order to straighten it on the bottom of the trench.
- If, as a result of location conditions, the cable is laid on the ground prior to trenching, the cable shall be laid out in the shape of a ‘figure eight’, to ensure that no undue bends, twists, kinks, compression or abrasions occur;
- If the cable is drawn into a cable trench using a cable winch, then cable rollers and corner rollers shall be provided in sufficient quantities to ensure that the cable does not graze the foot of the trench or trench walls and will not be exposed to unacceptable bending stress during installation. Installation tensile force shall be limited to the safe working load of the cable.
- Sand-encased cables in built-up areas or in areas of increased hazard can be protected against damage with cable protection covers or cable cover plates as specified by the customer.

- A warning tape shall be placed at a distance of 300 mm below the ground surface.

Jointing and Splicing

At jointing manholes sufficient extra cable shall be left to accommodate the cable ends being taken out of the manhole for splicing of the ends in a splicing van or trailer whilst preserving the manufacturer's recommended minimum bending radius. A further minimum allowance of 5 m shall be provided in each closure to make the fibre optic connections.

All slack cable shall be coiled neatly into the manhole in a slack box or cabinet, as specified by the customer. Care shall be taken that the manufacturer's minimum bending radius is adhered to and that no torsion is imparted to the cable. This also applies to installations using cable trays.

Accredited technicians shall carry out splicing of optical fibres. Splicing machines shall be capable of creating splices consistently better than 0,05dB. Splicing machines shall be properly calibrated and tested. Tools and measuring equipment shall be provided and used for each splice. Splice losses shall be as specified in annex A, unless otherwise specified by the customer.

The operation of jointing and splicing shall be in accordance with the manufacturer's instructions and shall follow the following sequence:

- Prepare the fibre optic cable
- Clamp the cable in the enclosure
- Fusion splice the optical fibres in accordance TIA 598-C
- Reinforce the splice point with heat shrinkable tube or by other means
- Secure and lay the optical fibres in the splice organizer inside the enclosure on completion of a permanent splice
- Close and seal the enclosure
- Loop the excess cable and secure the enclosure in the manhole ensuring that the cable manufacturer's recommended minimum bending radius is adhered to and that there is no torsion applied to the cable

At the termination points the fibres shall be spliced to optical pig tails. Care should be taken to ensure the sequence is in accordance with the customer specified splice plan. The type of pig tail required (primary coated fibre or ruggedized) and the type of connector shall be specified by the customer.

Splicing enclosures (joint boxes) shall be subject to customer's approval. All construction details and ingress protection (IP) ratings of the proposed units shall be provided. The splicing enclosures shall facilitate fibre organization and splicing requirements.

The bonding through and earthing of the armour/metallic protection shall be as specified by the customer.

Quality control

The quality control requirements shall be as specified by the customer. A quality management system based on SANS 9001, and effectively implemented product/process quality plans are essential elements

of these requirements.

Testing

Ducts

On completion of duct laying and backfilling the ducts shall be proved by pulling through a cylindrical cleaning brush followed by a wooden or Teflon1) mandrill 50 mm to 400 mm long, depending on duct size, and 5 mm less in diameter than the bore of the duct.

Teflon is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by the NRS Association of this product.

A blown sphere/shuttle or mandrel should not be undertaken without ensuring that provisions have been made to capture the sphere/shuttle or mandrel at the remote end and that the tube to be tested has been positively identified at each end.

The size and diameter of the blown sphere/shuttle should be an agreed percentage of the inner diameter of the duct.

Air test

The purpose of the air test is to verify continuity of the duct under test between two fixed points in the network, for example, manholes.

Air test procedure

Fit a catching device to the far end of the duct under test. Personnel between the far end and where the testing will be done much be able to communicate with each other using suitable communication devices.

At the test end, fit all safety devices to ducts and test assembly. Connect assembly to compressor via air hose and open gradually once confirmation from the far end has been received that all safety straps are fitted and the catching device is securely fitted to the duct under test.

Allow air to flow through duct at full pressure for at least one minute to remove all loose particles inside ducts. If air is emerging at far end of test section, close air and proceed to sponge test.

If no air emerges from far end the cause must be identified before any further testing can be done. On new duct installations the fault must be recorded on the DIT report and handed over to the installation contractor to rectify.

Possible causes for the failure of the air test can be pipes missing in sections, pipes not connected through in manholes, pipes damaged between manholes, failure of connectors or pipes connected to different coloured pipes in manholes.

Sponge test

The purpose of the sponge test is to clean the ducts of any dirt, insects and water that may have entered the duct. Any small obstacle can cause the mandrill to get stuck in the ducts and will also damage the low friction lining on the inside of the ducts.

Sponge test procedure

The following procedure shall be followed:

- release the connector from the test assembly attached to the duct after all air is released.
- insert high-density sponge as described and reconnect test assembly to duct.
- inform personnel at far end and open air gradually to full pressure.
- the sponge should arrive at far end within one minute. If the sponge blows out water and dirt, repeat the test with another sponge until duct is clean.

NOTE: Excessive water and dirt may delay the arrival of the sponge.

- If the test is successful, close air and proceed to mandrill test.
- The sponge can be left in the catching device at the far to reduce the impact of the mandrill.
- if sponge does not arrive at far end after reasonable time, record fault in DIT test report and hand over to the installation contractor to rectify.
- On existing installations, locate position of sponge and rectify before continuing to mandrill test.
- Possible causes for sponge getting stuck are duct blocked by excessive dirt or water, kink in duct and faulty connector.

Mandrill test

The purpose of the mandrill test is to verify that 85 % of the inside diameter of the duct is available throughout the entire test section for the successful installation of an optical fibre cable.

Multiple indentations and sharp bends in the duct will cause accumulated friction on the fibre cable and will limit installation distances drastically.

Mandrill test procedure

The following procedure shall be followed:

- Release connector from test assembly to duct after all air is released.
- insert correct size mandrill in accordance with the manufacturer's instructions and reconnect test assembly to duct.
- Inform personnel at far end and open air gradually to maximum of 3-bar pressure.
- The mandrill should arrive at the far end within one minute as a guideline for a 1000 m test section.

NOTE: On elevated areas of the route can the pressure be increased to a maximum of 5-bar.

- If the test is successful, close air and proceed to the pressure test.

NOTE: The condition of mandrill, visible grooves on the mandrill is an indication of indents in the ducts.

- If the mandrill does not arrive at the far end after a reasonable time, record fault in DIT test report and hand over to the installation contractor to rectify
- On existing installations, locate position of the mandrill and rectify before continuing to the pressure test

NOTE: Possible causes for mandrill getting stuck are duct inside diameter reduced by pressure on the duct due to rocks or stones in bedding and padding, kinks in duct, deformation of duct, sharp bends and faulty connector in a manhole.

Pressure test

The purpose of the pressure test is to ensure that the duct can hold a continuous pressure of at least 10-bar, which will be introduced into the duct during cable blowing. Pressure of up to 15-bar is used to blow micro cables into micro ducts.

Any leak in the duct can lead to possible damage of the fibre cable, as the cable will follow the path of the biggest airflow. Leaks in ducts will also reduce cable installation distances.

Pressure test procedure

The following procedure shall be followed:

- At the far end of test section, remove catching device once all the air is released
- Fit a high-pressure stopper to the duct end similar to the end cap fitted onto the catching device and secure duct end inside manhole
- Once the stopper has been fitted, gradually introduce air into the duct from test end up to 10-bar pressure
- Hold air feed open into duct until air pressure inside duct has stabilized on 10-bar
- Close air valve on test assembly and monitor pressure on gauge for 5 minutes
- No leakage will be accepted. Any leakage must be detected and rectified
- Tester must ensure that all couplings to duct are airtight, use soap water with sponge to detect any leaks on couplings

NOTE: Possible reasons for leaks are damage to ducts during transportation and handling resulting in holes, inferior quality ducts that cracks under pressure, faulty connectors and sharp edges of rocks in the bedding and padding material that can puncture ducts.

Cable fibre tests before installations

The integrity and attenuation of individual fibres shall be tested with the duct or direct-buried cable still on the drum, before installation. The test shall be performed for each fibre in the cable at two wavelengths, 1310 nm and 1550 nm or 1550 nm and 1625 nm, as specified by the customer from one direction only. When requested, testing shall be witnessed by the customer.
The identity of individual fibres shall be clearly marked.

The results of the tests shall be produced as shown in the example of table 1. The heading shall contain the drum number and the length of the cable.

The table shall record the attenuation of each fibre. Results shall be produced in paper and digital form (disc). If the drum test is successful, the contractor can proceed with the installation. In the case of failure, the drum shall be returned to the customer.

Unless otherwise specified in the contract requirements, the contractor shall be held responsible for the proper protection and safe keeping of the optical fibre cable drums until completion of the contract (takeover of the cable by the customer) and the return of any surplus material to the customer. The contractor shall be held responsible for any loss or damage to material required for or surplus to, the contract works.

All material received shall be neatly stored in properly defined storage areas to facilitate checking of quantities and quality. Receipt slips shall be forwarded to the customer within two days of delivery, and a record of the total quantities of material received and used, shall be kept on site.

Table 1 — Example of optic fibre site test results before installation

1	2	3	4	5	6
Project			Drum number		
			Loss dB/km		
Tube	Fibre	Colour	1310 nm	1550 nm	Length
1	1				
	2				
	3				
	4				
	5				
	6				
2	1				
	2				
	3				
	4				
	5				
	6				
NOTE Cables may use different configurations for example central tube design with bundled fibres.					

Cable fibre testing after completion of installation

After completion, the optical fibre cable shall be tested for integrity and attenuation of the optical fibres.

All joints shall be the fusion type and the average loss per splice for the whole route shall be less than that specified in annexure A, unless otherwise specified by the customer. Test results shall be recorded and presented.

An end-to-end light source and power meter test shall be performed and the results shall be recorded

and presented. Only a calibrated OTDR shall be acceptable. If requested by the customer, PMD tests shall be performed on the terminated optical fibre cable to show compliance with the system requirements.

Documentation

After completion of installation, the following documentation shall be given to the customer and approved by him on completion of the duct or direct-buried cable:

- Record of installation pulling tensions in chart form
- Line diagram showing position of cable/ducts and joints, including distance from main termination room and fibre allocation in the case of spurs etc.
- If specified, photographs of completed work shall be provided.

Acceptance procedure for fibre optic cable systems

General

This procedure covers the testing of fibre optic cable systems. These systems may consist of OPGW, ADSS, externally attached cables, duct or direct-buried cabling or a combination of the aforementioned.

Splice acceptance

All joints shall be of the fusion type and shall comply with the requirements given in table 2, or otherwise as agreed upon between the customer and the contractor.

Table 2 — Splice loss

1	2	
Splice losses	Single mode fibre	
Maximum	? 0,10 dB	
Mean dB	? 0,075 dB	
a. The individual splice loss is the numerical average of an individual splice as measured in both directions with an OTDR. b. The mean splice loss is the sum of all individual splice losses on a particular fibre divided by the total number of splices on that fibre.		

Any joint that has a measured loss higher than the specified value shall be broken and redone. If, after attempting to re-splice for a total of 3 times, the individual splice loss is still above the specified limit, the splice can be accepted provided that the mean splice loss is within the specified limits.

Fibre optic cable testing

The aim of these tests is to establish whether the fibre optic installation is acceptable or not. After installation, the complete system shall be tested from end to end. The customer shall be given the

opportunity to carry out final acceptance testing in conjunction with the supplier's staff. The customer's presence shall not relieve the supplier of his responsibility for the satisfactory performance of the equipment during site testing and thereafter through to the end of the warranty period.

Carry out the following for cable systems with one or more joints in the total length (excluding joints in fibre distribution units). Using an OTDR, take the basic measurements (i.e. attenuation coefficient, length and position and loss of splice joints) in accordance with SANS 60793-1-40.

Set the OTDR length range at least as long as the fibre under test to avoid ghosting and echoing. These phenomena are particularly evident at short lengths (< 1 km). Use the correct group refractive index as provided by the optical fibre manufacturer. Indicate this on the splice loss summary table given in Table 3.

Set the helix factor stipulated by the supplier and indicate it on the splice loss summary table (see Table 3). Indicate on the splice loss summary table (see Table 3) the back-scatter coefficient for each wavelength as supplied by the cable manufacturer. This information is required for record purposes.

Indicate acquisition time settings on the splice loss summary table (see Table 3).

Sample of splice loss summary table

Route :	A to B	Fibre type :
Cable type :	12 fibre duct	Refractive index : 1,468
End 1 :	A	Helix factor : 9 %
End 2 :	B	Backscatter coefficient :
Wavelength : Contractor name:	1550 nm	

Table 3 — Splice loss summary

	Tested from	Total length	Joint 1 distance	Joint 3 distance	Joint 9 distance	Joint 11 distance		
	End1	0	1926	5730	16686	20632		
	End 2	21144	19218	15414	4458	506		
Fibre No.	**Tested from**	**Total loss**	**Joint 1 loss**	**Joint 3 loss**	**Joint 9 loss**	**Joint 11 loss**	**Mean loss**	**Worst splice loss**
1	End 1	5,11	0,11	0,00	0,00	0,00	0,04	0,09
1	End 2	5,324	0,06	0,12	0,00	0,00		
1	Average	5,21	0,09	0,06	0,00	0,00		
2	End 1	5,43	0,00	0,23	0,00	0,00		
2	End 2	5,21	0,00	-0,10[a]	0,00	0,00		
2	Average	5,32	0,00	0,07	0,00	0,00	0,02	0,07

11	End 1	5,41	0,00	-0,07[a]	0,06	0,11	0,04	0,11
11	End 2	4,90	0,00	0,09	0,00	0,11		
11	Average	5,15	0,00	0,01	0,03	0,11		
12	End 1	5,02	0,09	0,00	0,05	0,06	0,06	0,10
12	End 2	5,58	0,10	0,17	0,00	0,00		
12	Average	5,30	0,10	0,09	0,03	0,03		

NOTE 1 Total loss is the total loss as read off during end to end testing and not only a sum of the joint losses.

NOTE 2 The above table is shortened for the sake of brevity and is not intended to represent real value. It is for illustrative purposes only.

[a] This value indicates a gain at the joint due to a variation in the MFD of the two fibres.

An end-to-end attenuation using the light source or power meter technique similar to the example given in table 4

Sample of light source and power meter summary table

Route : A to B

Cable type : 12 fibre duct

End 1 : A

End 2 : B

Route length : 21 km

Wavelength : 1550 nm

Reference : -7,3 dB

Contractor name:

Table 4 — Light source and power meter summary

1	2	3	4	5
Fibre No.	**Tested from**	**dB/km**	**Received level dB/km**	**Loss dB**
1	End 1	0,24	–12,4	5,1
1	End 2	0,25	–12,7	5,3
2	End 1	0,26	–12,5	5,4
2	End 2	0,25	–12,3	5,2
3	End 1	0,25	–12,8	5,3
Etc.				

NOTE The table is shortened for the sake of brevity and is not intended to represent real values. It is for illustrative purposes only.

For normal attenuation measurement, the wavelength tolerance shall be within ± 20 nm of the normal central wavelength, for example 1 310 nm or 1 550 nm. For line lengths up to 50 km, attenuation

measurements shall include both wavelengths. For lines exceeding 50 km wavelength, tests need only be done at 1 550 nm.

Use launch fibre or dead-zone fibre of a suitable length and indicate as such in the test results. Take only bidirectional measurements.

OTDR traces shall provide for the complete length of fibre (patch panel enclosure to patch panel enclosure), indicating the distance to joints and the total length of the fibre as well as the loss at each joint.

Do the tests in both directions at both 1 310 nm and 1 550 nm windows, as specified above. And provide test results on a data disc in raw format and pdf copy.

NOTE: The best method to determine splice loss is the vertical separation of two best-fit straight lines, usually requiring placement of a pair of cursors on each side of the splice. Most modern instruments support this method as a standard function.

Bidirectional measurements under the same test conditions are required to eliminate the effects of back-scatter coefficient differences.

The calculation of loss is done by averaging the bidirectional readings. Ensure that the event analysis, event thresholds and event notifier are set. Adhere to the OTDR maximum pulse widths as given in table 5.

Table 5 — OTDR maximum pulse widths

1	2
Range km	Maximum pulse width ns
< 2	100
> 2 and < 20	500
>20 and < 50	1 000
> 50	2 500

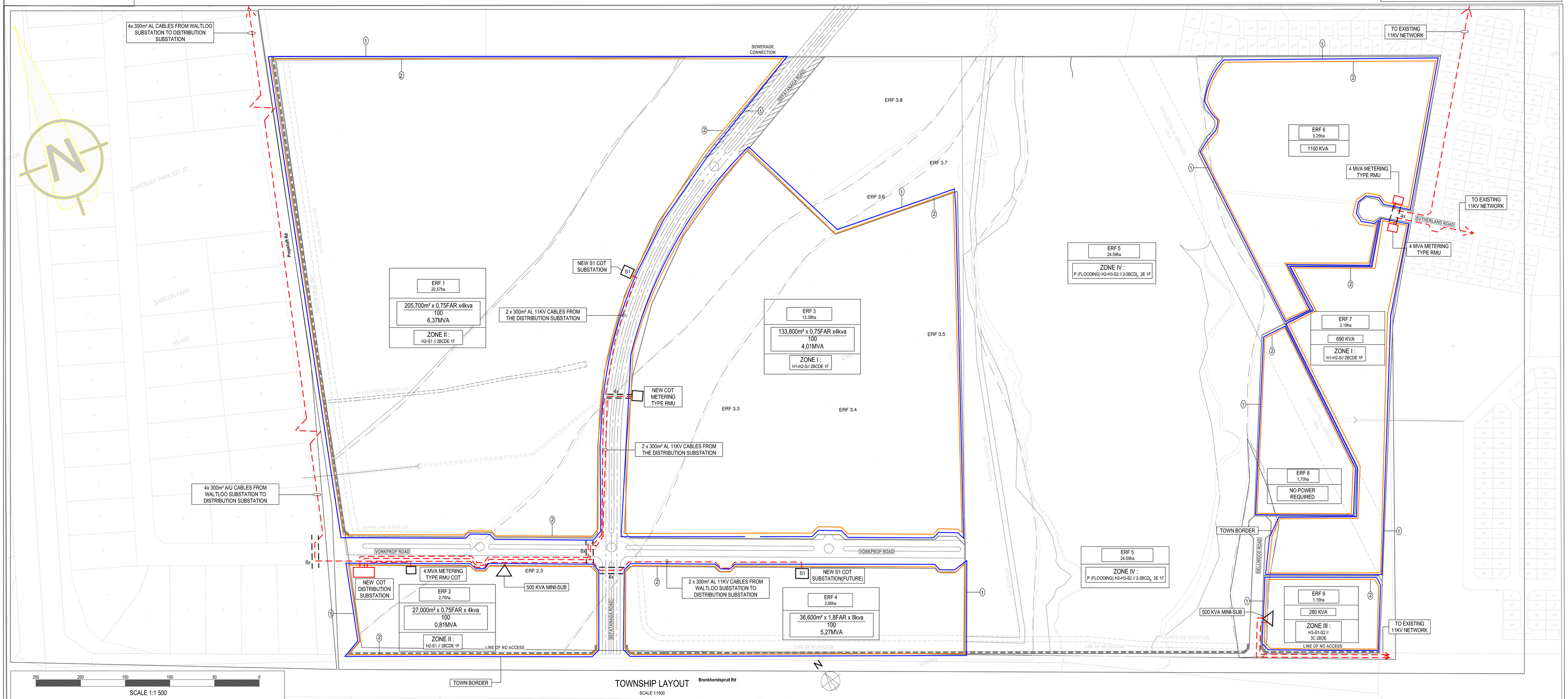
Insert the following information on each OTDR trace:

- The date of the test
- A description of the fibre optic cable
- The fibre number
- The end from which the test is performed
- The refractive index
- The helix factor
- The Rayleigh back-scatter coefficient

FOR APPROVAL

LEGEND		
NO	SYMBOL	DESCRIPTION
1		TOWN BORDER
2		ERF BORDER
3		4 x 300m2 x 3 CORE AL 11KV CABLES
4		2 x 300m2 x 3 CORE AL 11KV CABLES
5		NEW 4MVA COT METERING TYPE RMU
6		NEW 500KVA 11KVA 400/23KV MINI SUBSTATION
7		NEW COT DISTRIBUTION SUBSTATION
8	SI	NEW COT SI SUBSTATION INTAKE & CONSUMER SUBSTATION
9	X2	110mmØ ELECTRICAL CABLE SLEEVES X NO. INDICATE NUMBER OF SLEEVES.

REFER TO DETAIL DRAWINGS



NO	DATE	DRAWN	AMENDMENT	REQUESTED	CHECKED
7					
6					
5					
4					
3					
2					
1					
0					

IMPLEMENTING AGENT

COEGA DEVELOPMENT CORPORATION

COEGA DEVELOPMENT CORPORATION

COEGA BUSINESS CENTRE PRETORIA
145 HERBERT ROAD, EASTWOOD
ARCADIA, PRETORIA, 0083
SOUTH AFRICA
TEL: +27 12 451 8300

CONSULTANT

HENRY FAGAN
Consulting Engineers & Project Managers

GAUTENG OFFICE

SUITE 13, RIVONIA GATE
381 RIVONIA BOULEVARD
RIVONIA, SANDTON, 2191

TEL: +27 10 500 1486
WWW.HENRYFAGAN.COM

WESTERN CAPE OFFICE

SUITE A2, GROUND FLOOR
BUILDING 2, NORDIC PARK 2
17 BOUNDARY ROAD
CENTURY CITY, 7441

TEL: +27 21 423 0873
WWW.HENRYFAGAN.COM

	Date:	Signature:
VERIFICATION BY ELECTRICITY INFRASTRUCTURE PLANNING AND DESIGN: 400V/11kV/132kV		
VERIFICATION OF DESIGN BY ENERGY AND ELECTRICITY DEVELOPMENT DIVISION		
ELECTRICAL DEVELOPMENT		

ENERGY AND ELECTRICITY DIVISION
PO BOX 423
PRETORIA
0001

TEL: 012 358 4407
FAX: 012 358 4397

CITY OF TSHWANE
IGNITING EXCELLENCE
PUBLIC WORKS AND INFRASTRUCTURE DEVELOPMENT DEPARTMENT

APPROVED BY:

FOR TSHWANE ENERGY & ELECTRICITY DEVELOPMENT DIVISION

DATE:

TASEZ PHASE - 2: ELECTRICAL BULK INFRASTRUCTURE PROJECT

SITE LAYOUT

CONTRACTORS DRAWING NUMBER	Actual Paper Size	Designed by:	Drawn by:	FA-0001
FA-0001	A0	K.Nel	T.Ledwaba	Sheet 1 of 1
				Scale:As Indicated

FORM OF OFFER

The Principal Contractor has solicited offers to enter into a Sub-contract agreement with an SMME Contractor for the procurement of:

Project Name: _____
Package No.: _____
CIDB Grade: _____

The Tenderer, identified in the Offer signature block, has examined the documents listed in the Tender Data and any addenda thereto as listed in the returnable schedules, and by submitting this offer, has accepted the conditions of tender.

By the representative of the Tenderer, deemed to be duly authorized, signing this part of the Form of Offer, the Tenderer offers to perform all of the obligations and liabilities of the Sub-contractor under the Contract, including compliance with all its terms and conditions according to their true intent and meaning, for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

Tender Validity Period: 120 calendar days

THE OFFERED TOTAL PRICE INCLUSIVE OF VALUE ADDED TAX (VAT) IS:
.....
.....
.....
Rand (in words):
R ..... (in figures)

B-BBEE INFORMATION

B-BBEE Level: _____
Percentage of Designated Group Ownership:

- Black: _____ %
- Women: _____ %
- Youth: _____ %
- Persons with Disabilities: _____ %

The Principal Contractor may accept this offer by presenting the SMME Contractor with a completed Letter of Appointment and Special Conditions of Subcontract for acceptance before the end of the period of validity stated in the tender data, whereupon the Tenderer becomes the party named as the Sub-contractor.

Signature(s): _____
Name(s): _____
Capacity for the Tenderer: _____
(**Name and address of organisation**):
Contact Number: _____
Name and Signature of Witness: _____
Date: _____
CIDB Registration No.: _____

TENDER RETURNABLE SCHEDULE

Project Name: _____

Tender Reference No.: _____

Tenderer Name: _____

CIDB Grading Applied For: ___ Grade ___

PART A: RETURNABLE DOCUMENTS FOR GRADES 1 TO 3

The following documents must be submitted for Tenders in CIDB Grades 1 to 3. Failure to submit any of these documents may result in disqualification.

No.	Document Description	Submitted (Yes/No)	Comments/Remarks
1	Priced Bill of Quantities (BOQ)		
2	Copy of Company Proof of Address (from the Ward Councillor)		
3	Copy of CIDB Certificate		
4	Copy of B-BBEE Certificate or Affidavit		

PART B: RETURNABLE DOCUMENTS FOR GRADES 4 TO 7

The following documents must be submitted for Tenders in CIDB Grades 4 to 7. Failure to submit any of these documents may result in disqualification.

No.	Document Description	Submitted (Yes/No)	Comments/Remarks
1	Priced Bill of Quantities (BOQ)		
2	Copy of Company Proof of Address (from the Ward Councillor)		
3	Copy of CIDB Certificate		
4	Copy of B-BBEE Certificate		
5	Experience on Similar Work (with Contactable References)		Grade 4: 1 reference, Grade 5: 2 references, Grade 6: 2 references
6	Organogram of the Project Team		
7	CVs and Qualifications of Core Staff (Project Manager, Supervisor, Contracts Manager, Artisan)		

DECLARATION

I, the undersigned, declare that the above returnable documents have been completed and submitted as required:

Name of Authorised Representative: _____

Signature: _____

Date: _____